COAL AGE

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DEVOTED TO THE OPERATING, TECHNICAL AND BUSINESS PROBLEMS OF THE COAL-MINING INDUSTRY

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Meter vs. Demand Peaks

IN SOME CASES where a mine power plant has been built to replace purchased power, difficulty has arisen because the demand for short periods proved greater than anticipated. The average maximum demand of a purchased-power schedule — usually a 15-minute demand—is sure to be far less than the averages over the shorter periods, which rule the overload ability of the power-house generating equipment. For example, a motor delivering 300 hp. to a hoist at a shaft 100 to 150 ft. deep will operate at full load only during a small percentage of the time and will add, perhaps, less than 100 hp. to the 15-minute demand; the same hoisting load, if switched to a small individual generating plant, may add a full 300 hp. to the demand during short periods and slow down generators already operating at or near full load.

Just what period of peak-load duration is the ruling factor depends, of course, on the number, size and type of generating units in service. For the typical mine power plant, the safe method is to install equipment which will handle the peaks as registered by an ordinary graphic wattmeter or graphic kilovolt-ampere meter. Due to instrument lag and dumping, however, these are not instantaneous peaks—as contrasted with the peaks of an oscillograph chart—and may be termed "recording meter peaks."

Data on one plant put into service last year show the great difference that can exist between a 15-minute maximum demand and a recording-meter peak even in a plant above average size. On purchased power, the kilovolt-ampere mine load ran close to, but did not exceed 3,000. The recording-meter peaks on the new power plant, carrying substantially the same mine load, indicated 4,170 kva.—an increase of 43 per cent over the 15-minute average. This particular plant, however, was designed with a capacity in excess of its recording-meter peak.

Mine Fog

DUST is suspended in mine air more readily when it contains fine particles of water, just as it will hang as a pall over a city when moisture is present. A wetting agent that will destroy the surface tension of the water is needed if the dust is to settle. In some cases, perhaps, it might be desirable for the finest of the dust, if not siliceous, to float out with the return air rather than gather in the mine, though suspended bituminous coal dust, even when dampened, may be dangerous, and perhaps old and extremely fine dust by oxidation may lose its explosivity with passage of time.

But if siliceous dust is to be settled by water sprays, they should be made effective by a wetting agent, or the fine water from the spray may hold the dust in suspension. For this purpose castor oil has been used by Charles Wetherill in England, but an immense number of other effective wetting agents, dispersives or penetrants suited for this purpose have been developed for the textile industry, some of which should be found harmless, non-lung-coating, non-irritating and non-medicinal.

TVA—and After

REFUSING to consider the TVA activities and aspirations outlined in the dissenting opinion of Justice McReynolds germane to the case at bar, the Supreme Court has given its sanction to the government's Wilson Dam power program. How far this sharply limited approval will be a precedent doubtless will be debated in legal and utility circles for months

to come. Forehanded business men more interested in action than in argument, however, will do well to assume that the same line of reasoning which upheld the Wilson Dam program can and will be applied to other federal power projects advertised as "yardstick" enterprises to the public and described as simply incidental to navigation and flood control when challenged in the courts.

As has been repeatedly pointed out, whether such proposals are wise, economically sound or socially desirable is no concern of the courts, who look only to the question of the constitutional mandate for the exercise of Congressional authority. Since this is so, it would seem to be the sounder strategy to oppose those projects believed to be harmful to private industry and alien to accepted concepts of governmental functions at the source. That means shifting the major battle from the judicial to the legislative arena. The importance of such a shift is well indicated by the quick revival of Congressional interest in various river-valley-authority schemes temporarily allowed to languish while the TVA was under judicial scrutiny.

Unless, therefore, private industry shows more aggressiveness than it marshaled against TVA legislation, more concentrated and concerted effort to convince Congress of the unwisdom of such schemes, we may expect further expansion of government activity in the power and related fields. The coal industry —both management and labor—has a definite stake in that fight. Investments and employment alike will be jeopardized by unwise and uneconomic development of hydro-electric power—particularly at this time, when the burden of national unemployment is still so great. And unless mine labor joins wholeheartedly in the fight, many of the mine workers who have so enthusiastically indorsed the present national administration may awake to discover that they have indorsed themselves out of their jobs.

Rollercoasting Water

TO PREVENT acidification, mine water, unless sealed against air, should be removed from the mine as quickly as possible. Every time water ebbs, air is allowed to reach sulphur-laden coal and floor, and ferrous sulphate is formed; whenever it rises, it dissolves the sulphate and the water becomes acidified. If a pipe received the water at the face and carried it direct up and down the sinuosities of the floor, the water would not come in contact with acid-making pyrite or its derivatives. Moreover, the continuous flow of water would save many pumps en route, save on power and maintenance, eliminate attendance and protect the pipe against corrosion.

Branch pipes with check valves would gather in most cases water collecting in side swags or along the route of the pipe, and the roads would be dry, preserving ties, rails, track alignment and bonding. Continuous flow of water would keep working places dry and, by lessening moisture content, reduce timber rot and floor deterioration, and perhaps also ferrous-sulphate formation.

The City of New York takes much of its water in a pipe under the Hudson River and up on the other side, solely by virtue of the hydraulic gradient. Many drainage troubles in mines would be eliminated by extending the pipe not only so far as is necessary to clear the summit between one swag and the next but far enough to carry the water past all intermediate summits to the sump or mine opening.

Ammonia for Engines?

FROM PROFESSOR HALVORSEN, University of Oslo, Norway, comes the suggestion that ammonia be used instead of oil for internal-combustion engines. New uses for ammonia is a crying need of the coal industry, though industry's first guess—agriculture—probably is its best, as soon as better methods of application are developed, for ammonia is a poor combustible, having only half the heat value of benzol or gasoline.

Ammonia does not form the poisonous gas, carbon monoxide, when burned, but it generates nitric acid, which is even more deadly. Halvorsen suggests that the ammonia be enriched with other liquid fuels, such as aldehydes, which also are possible derivatives of coal. Prospect of its adoption seems remote, especially in America. Inasmuch as nitrogen compounds have been so greatly desired in the past, and still have important agricultural uses, it would seem ill-advised that they be relegated to heat generation.

CONVEYOR MINING

+ Recovers Low Coal at Affinity

And Adds Years to Plant Life

COAL too thin for hand loading methods; use of chain-and-flight conveyors; mining 40-ft. rooms and bringing pillars back open-ended; an average of 10.6 tons per man, including conveyor movings and all other labor up to the main haul—these are the highlights of the 1935 conveyor installation in the Beckley seam drift mine of the Pemberton Coal & Coke Co., Affinity, W. Va. The first four-room unit was put into regular service late in February, 1935, and early in October a duplicate unit was installed. In spite of short running time during several of the months, conveyor output from March 1 to Dec. 15, 1935, was 57,817 tons.

Although places as low as 28 in. have been encountered in the mine and have been advanced successfully with the conveyors, the average working heights in the present locations are 32 and 40 in., respectively, for the two set-ups. About 10 in. above the bottom is a 2- to 2½-in. binder of bone to which ½ in. of coal adheres. Thus, the material that must be picked out and thrown back over the conveyor into the gob averages about 3 in. The mine bottom is a hard slate and the top a strong sandstone which does not break until all of the coal has been removed from areas approximating 300x300 ft. Other favorable conditions are a generally level lie of the coal seam, with local grades seldom exceeding 5 per cent, and absence of both water and gas in the working places.

Equipment comprising a conveyor unit at Affinity is as follows: four short-wall mining machines, one hoist for handling trips at the loading station, four permissible one-man electric drills, four 12-in. blowers (rated 1,500 c.f.m. through 12-in. tubing up to 300 ft.), 300 ft. of 12-in. Ventube, four 30-ft. face conveyors, four 300-ft. room conveyors, one 300-ft. gathering conveyor, one 10- to 15-ft. elevating, or car-loading, conveyor and four 300-ft. lengths of duplex rubber-sheath cable with portable reels. Mining-machine equipment consists of units in service at the mine for many years, recently fitted with thin- (4½-in.) kerf 7½-ft. cutter bars.

As before stated, two complete units are in service in the mine. Investment per unit is approximately $25,000 including the mining machines properly valued as used-and-rebuilt equipments. If new mining machines had been purchased, the total investment per unit would have been $45,000.

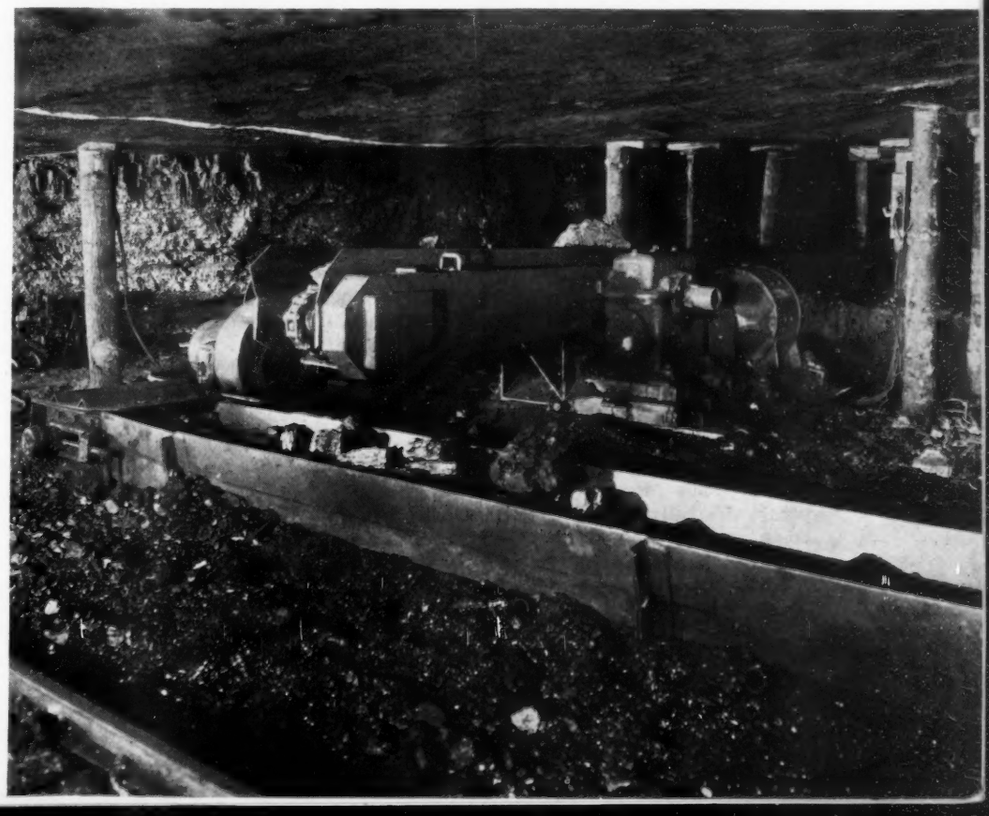
Rooms are driven 40 to 43 ft. wide on 72-ft. centers and are extended to cut into the aircourse, the center of which is 300 ft. from the loading entry. Room necks are cut three times while the entry is being advanced. Two of the cuts are loaded out, thus making space for the initial set-up. Usually, the room pillar, which is about 30 ft. wide, is mined at an angle to provide a face length of 35 to 40 ft.

To date, most of the conveyor mining has been in territory where entries had been developed some years ago. Consequently the conveyor rooms have been worked advancing. In new territory now being developed the work will be on retreat. Temporarily, one 300-ft. conveyor has been borrowed from a room and is being used in this entry development. Three shifts advance a heading 40 ft. per day. After one heading of the entry has been driven 300 ft. ahead, the conveyor is moved into the other heading to continue the cycle.

Because of the favorable roof condition and the more rapid extraction, timbering cost is slightly less than in a hand-loading section in higher coal. A row of six posts is set for each 6-ft. cut. Thus, the timber rows are on 4- and 6-ft. centers. Only in a few instances have posts been set ahead of the face conveyor and no movable posts or cribs of the emergency type have been required. Figuring timber at 2c. per linear foot, assuming an average of 25 tons of coal per cut, and adding a charge for cap boards, the indicated timbering cost approximates 2c. per ton.

Cover over the conveyor workings is

Partially hid by the discharge end of the room conveyor is the blower which forces air to the face through a 12-in. fabric tube (view from camera position *B*, Fig 2)



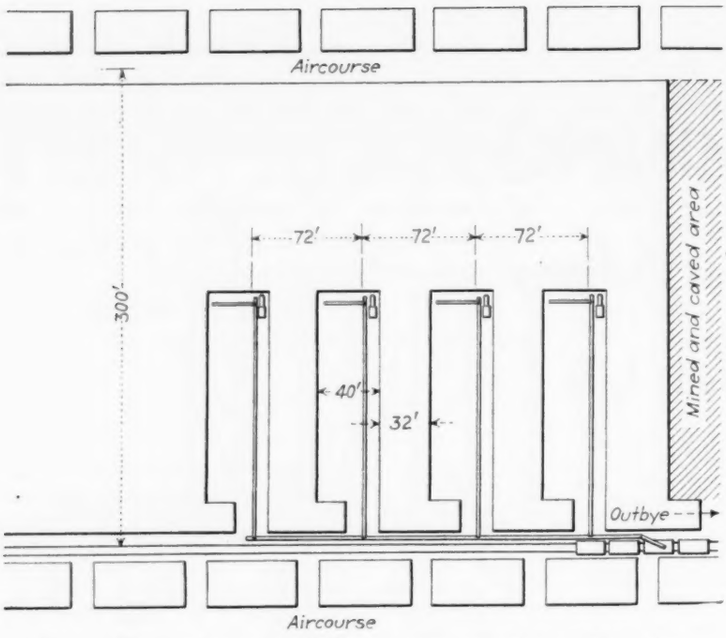


Fig. 1—The four rooms worked by a conveyor unit are advanced at approximately the same rates

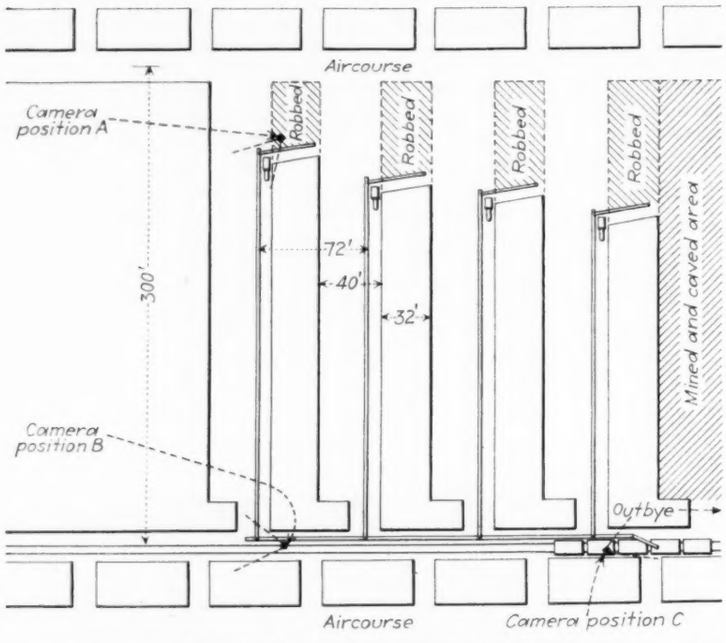


Fig. 2—Because the top holds until the 300x300-ft. block has been mined, robbing pillars on retreat can be done without maintaining a 45-deg. break line, as was done at the beginning

250 to 300 ft. and the roof breaks extend to the surface. The plan originally followed was to time the extraction of the four pillars of a working set-up so as to maintain a 45-deg. break line. To accomplish that, the regular two-shift working schedule was varied on certain pillars, at times, to speed the retreat and maintain the angle. However, as experience has demonstrated that roof breaks normally do not occur in a four-room area until after all of the pillar coal has been removed, it is now the practice to drive rooms abreast of each other and to mine the pillars back in the same relation. Usually, unaided by prop shooting, the top falls a few days after mining of the four pillars has been completed.

Undercutting of both room and pillar coal is done on the bottom and no scrapping is required. Pellet powder originally was used for breaking down the coal, but recently a change was made to a permissible explosive. Firing of the six shots per face, one shot at a time in quick succession, is effected by hand operation of a special shooting rheostat powered from the 250-volt mine circuit. Delay detonators, which were adopted when the conveyor mining was begun, were displaced by the shooting rheostat method in order to save the difference of approximately 14c. each between the costs of delay and plain detonators. Details of the shooting rheostat appear on p. 110 of this issue. In some instances pillar cuts break down from roof action and few if any shots are then required.

A conveyor unit crew consists of nineteen men. Four face men per room (four rooms) do the cutting, drilling, shooting, timbering, loading, conveyor moving and incidental work. The mining-machine operator is the leader in each room. One car trimmer stationed at the loading point on the entry, one mechanic and one foreman complete the list of nineteen. All are paid the machine rate of $5.46 for seven hours' work, and even the mechanic, who is responsible for oiling, maintaining electrical connections, making minor repairs and changing machine bits, loads coal when the foreman finds it advisable.

Two types of mine cars—wood and steel—constitute the haulage equipment. The steel cars being the larger, their average loading is 3.1 tons, as compared to an average of 2.65 tons for all cars. Outside dimensions of the steel cars are: height, 24 in.; length, 14 ft.; and width, 6 ft. 2 in. A 15-ton Westinghouse locomotive pulls the conveyor-loaded trips of 15 to 30 cars from the parting, which is within 100 ft. of the conveyor loading point, to the tipple. The delay

Table I—Production From Conveyors in 1935

Month	Tons
March	5,437
April	4,582
May	2,580
June	6,556
July	5,531
August	5,946
September	5,760
October	9,798*
November	7,466
December (first half)	4,161
Total	57,817

*Only month of full running time—worked 24 days.

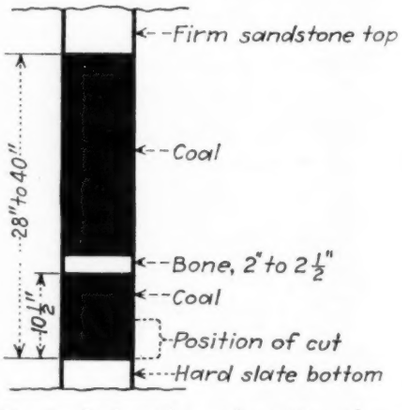


Fig. 3—Coal section and position of cut

to conveyor loading while this locomotive pulls to the parting and places the empties on the loading track is but 2 or 3 minutes.

Of the 1,200 tons per day total mine production, 800 tons comes from the conveyor sections and 400 tons from hand-loading sections. The preparation includes hand picking, screening, and washing of the 6x1-in. fraction in hydro-separators, which were installed at the plant long before conveyor work was contemplated. Prepared sizes go to the domestic market, the slack largely to byproduct plants, and at times some coal is shipped for steam purposes.

Ohio Brass Type KSD automatic starters are installed at each 10-hp. room conveyor drive; all other electrical controls were supplied by the Jeffrey Mfg. Co. In normal operation the KSD starters are controlled from the car-loading point, but for reversed operation to carry timber and other supplies to the face, a man must operate a Jeffrey Class 7 reverse switch installed at the respective room drive. To provide for operation of the gathering conveyor with one or more room conveyors stopped, a Class 11 magnetic contactor is included with the controls of each room drive.

Face conveyors are started by single-pole single-throw switches located at the motors, and the same type of switch is used for starting the elevating conveyor. A Class 21 manual drum controller similar to that used on Jeffrey 35B machines serves as the starter for the 15-hp. gathering conveyor.

Calculations from data of operating tests to determine power input to each conveyor and blower indicate a 43-kw. demand when all conveyors and blowers of a unit are operating. Peak loads for the entire equipment of a unit, of course, are much larger and occur when one or more of the cutting machines are in service. The intermittent load of the 5-hp. hoist motor does not materially affect power consumption.

Assuming 20 per cent loss in transmission from substation to the motors, the total power used by conveyors and blowers amounts to approximately 1.5 kw.-hr. per ton. Thus, if a power rate of 2c. per kilowatt-hour at the d.c. bus is assumed, the power cost to operate blowers and conveyors is 3c. per ton. Supplies, including explosives, picks, shovels, mining-machine bits, wire ropes and repair parts, have amounted to 5c. per ton.

Size No. 1/0 cables 300 ft. long are used from room neck to face. The cables recently purchased are General Electric flat-style tellurium-compounded all-rubber finish; conductor stranding, 7x19; wire diameter, 0.028 in. In service, the cables are handled on reels mounted on skid stands and fitted with slip-ring connections.

As has been the case at several other mines, this installation of conveyors at

Gathering and elevating conveyors from camera position *C*, Fig. 2

Face equipment as it appears from camera position *A*, Fig. 2

Affinity appears to have brought a new lease of life to the property. Coal areas which a few years ago were considered too thin for profitable mining have become "available tonnage." T. C. Weeks, who lives at Affinity, is general superintendent of that mine and of another mine, Big Stick No. 2, situated a few miles away on the same line, the Winding Gulf branch of the Virginian Ry.

Table II—List of Equipment in Each Conveyor-Mining Unit*

	Number Used Per Unit	Make	Type	Intermediate Sections: Height	Intermediate Sections: Length	Total Length, Ft.	Motor Rating, Hp.	Motor Make	Rating, Tons per Minute
Face conveyors	4	Jeffrey	61-HG	6 $\frac{5}{16}$ in.[1]	5 ft.	30	5	W	1
Room conveyors	4	Jeffrey	61-AM	9 in.	6 ft. 1$\frac{3}{4}$ in.	300	10	W	$\frac{3}{4}$
Gathering conveyors	1	Jeffrey	61-W	10$\frac{1}{4}$ in.	6 ft. 1 in.	300	15	W	1.2
Elevating conveyors	1	Jeffrey	61-EW	.....	.....	15[2]	5	W	...
Drills	4	Jeffrey	A7, one-man, permissible, 38-lb.	.....	.....	...	1$\frac{1}{2}$	....	...
Blowers	4	Jeffrey	12-in.	.....	.....	...	1$\frac{1}{4}$	R-M	...
Hoists	1	Brownie	HKC	.....	.....	...	5	....	...
Mining machines	4	Goodman Shortwall	12-AA	.....	.....	...	50	....	...

*Exclusive of four 300-ft. lengths of rubber-sheathed duplex cable on portable reels and ventilating tubing.
[1] Height without detachable sideboard. [2] Being used without intermediate section, thus reducing total length to 11 ft.
W, Westinghouse; R-M, Robins & Myers.

Table III—Power-Test Data on Conveyors and Blowers

	Motor Rating, Hp.	Power Input.—Hp.	Power Input.—Kw	Volts—Max.	Volts—Min.	Volts—Av.	Number Per Unit	Demand Per Unit, Kw.
Face conveyor	5	2.01	1.5	260	140	200	Four	6.0
Room conveyor	10	6.33	4.73	240	180	206	Four	18.92
Blower	1$\frac{1}{4}$	1.76	1.32	255	200	231	Four	5.28
Gathering conveyor	15	13.75	10.78	225	170	196	One	10.28
Elevating conveyor	5	3.62	2.70	245	230	240	One	2.70
								43.18

COAL PREPARATION—

+ What Should Bituminous Coal Operator Consider In Modernizing Cleaning-Plant Facilities?

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THE rigid specifications which govern the purchase of coal today justify consideration and attention being given to new preparation plants and cleaning methods. In reaching a decision, however, the coal operator is confronted not only with the question, "How far will I *have* to go in the matter of preparation in order to meet competition" but "How far *can* I go economically in the matter of preparation to meet specifications?"

Where once coal of a certain general type proved satisfactory to the market, there is now a growing demand for fuel of closely defined limits and specifications, not only with respect to chemical composition and other characteristics but also the analysis and character of its ash. This is becoming more and more evident with development of the art of combustion, and the constant endeavor to increase the efficiency of bituminous coal in the metallurgical and byproduct industries, and its widening use for other purposes.

These new conditions have created demands which the bituminous operator is endeavoring to meet, but, unless they are met with full knowledge of all of the phases of the problem involved, it may prove as destructive as the price competition from which the industry is ever endeavoring to escape. Practically from its inception, due to the character of its raw material, the anthracite industry has been required to include some form of cleaning, washing and sizing, and such requirements have become practically standardized. It has the advantage that its price scale accepts these requirements and provides for them.

On the other hand, the bituminous industry, not as favored with a uniformity of its carbonaceous product, must endeavor to meet the increasingly critical demands of consumers, with some mines having an almost natural purity of material, while others have coals requiring considerable treatment to meet requirements. Some bituminous coals lend themselves readily to improvement, but others, due to their natural chemical and physical characteristics, cannot be as easily treated. A preparation problem, to be successfully solved, must be considered not only from a cleaning standpoint but upon the basis of three main controlling factors:

1. Economics of preparation.
2. Chemistry of preparation.
3. Mechanics of preparation.

To the operator who has previously enjoyed a market for his coal with simple preparation the problem of changing over to a more complex system, which might include screening, washing, crushing, air cleaning, etc., with the attendant costs, is basically an economic one. The value of an installation to the operator, in the final analysis, should represent a profit. This profit may be in the form of an increased sales price or in the reduction in operating costs through increased operating time. Or, it may help to maintain a profit which is disappearing or is being jeopardized by lack of proper preparation methods.

"Load Factor" in Plant Design

Due to its important effect on the economic success, one of the first considerations to be given this phase of the problem is a conservative forecast of probable production after the contemplated improvements in preparation have been made. The value of the load factor is readily recognized in the electrical industry, but its value is not always given consideration in the coal industry. The sliding scale of mining and operating costs, dependent upon the amount of production, while influenced in each case by local conditions and varying for each mine, represents a basis of calculations. The danger of overoptimism in this respect is readily apparent. To calculate costs on the basis of a full operating year at 100 per cent capacity often looks well when figured on the back of an envelope, but it does not give much monetary credit to a new plant that will work only part time or spasmodically.

Initial cost of a plant considered in relation to its reserves represents another important consideration. Serious error can be made by a false sense of economy in initial plant construction cost, with a later operating cost far exceeding the initial savings. Shutdowns to make repairs to a piece of equipment which was built too light for the work intended will generally represent a loss much more than the difference in initial cost between that piece of equipment and one of proper design. While this applies to all equipment, it is especially applicable to the installation of washery equipment.

The dollar-and-cents difference at the end of a year between a washery which is cleaning coal to a certain content with only 8 per cent reject, as against less efficient equipment cleaning the same coal with a 10 per cent reject, is definite. In the case of the 8-per-cent-reject plant, on an assumed basis of mining and operating costs of $1.90 per ton of raw coal, the final cost of the cleaned product is $\frac{100}{92} \times \$1.90 = \$2.07$ per ton, or a conversion loss of 17c. per ton. In the case of the 10-per-cent-reject plant, with the same raw coal and cost, the final cost of the cleaned product is $\frac{100}{90} \times \$1.90 = \$2.11$ per ton, or a conversion loss of 21c. per ton. With a 1,000-ton-per-day plant, operating 200 days per year, this difference amounts to $8,000. This amount, if applied directly to capital cost or a sinking fund for a larger expenditure, is ample to justify the cost of washing equipment with quantitative and qualitative efficiency suitable for the coal which it is intended to clean.

The value of increased realization from improvement in preparation is variable, dependent upon the market

served. One thing is certain, however: That whatever class of coal is used, its preparation must be such as will enable it to meet competitive market requirements. Sizing as a primary basis for valuation is and will continue to become of less importance. The very convenience of the larger sizes in the handling and firing, for which much of the premium was formerly paid, is the same convenience which is now obtained to a greater extent with smaller coals, and with greater efficiency. The consumer's scale of values is now based upon the economic good he receives from the coal and in the form which gives him the most effective heat units for his money.

The tremendous development and growth of the stoker industry is having a profound influence on the coal industry both from a preparation and a sales standpoint. This is an encouraging development for the coal industry, as, by providing a convenient, efficient and economical method for the use of coal, it has provided a means of competing with other fuels. It has reduced the price of heat to the consumer far beyond that which would have been possible by reduction in the price of coal. Every encouragement should be given to this development and a coal preparation provided which will meet its requirements.

With the development of this industry, however, much has been printed in various coal users' trade journals relative to the savings which accrue to the consumer by the use of coal with a lower ash content. While this is true, the calculations seldom show what portion of this saving rightfully should accrue to the coal producer for the loss he is put to in creating such lower-ash fuel. The coal industry is entitled to an increase in price in some proportion to this increased value of the coal to the consumer.

The problem which the operator must have determined for him is: Can his coal be prepared at a cost equal to, or less than, the extra value he can receive from the preparation contemplated? This depends largely upon the composition of the coal itself. And it is doubtful if Nature, in supplying any raw material to mankind, has allowed herself as great a latitude in variety as she has in the composition of bituminous coals.

Geologists estimate that it required a minimum of from 300 to 400 years for the growth of vegetation necessary for the formation of the thickness of one foot of bituminous coal. On this basis it can be assumed that from 1,200 to 1,600 years, at least, was required for the growth of vegetation necessary to form an ordinary 4-ft. seam of coal. Added to this were periods of volcanic eruption, inundations, sandstorms and mud and silt infiltrations, such as are evidenced by the partings and infiltrations in a coal bed. Conditions varied as to time and place, as well as to vegetation. There were periods of pressure and heat, with the consequence that we have today an almost limitless variety of coal formations.

The development in comparatively recent years of wide possibilities in the use of coal not only for heat and energy but also as raw material for an increasing number of industrial purposes has led to the increased breaking down of this heterogeneous and complex coal material into more and more of its chemical components. Much progress is being made in this regard and the limits are not yet defined, but to the operators producing coal for established uses and for immediate requirements the problem need not be so complex.

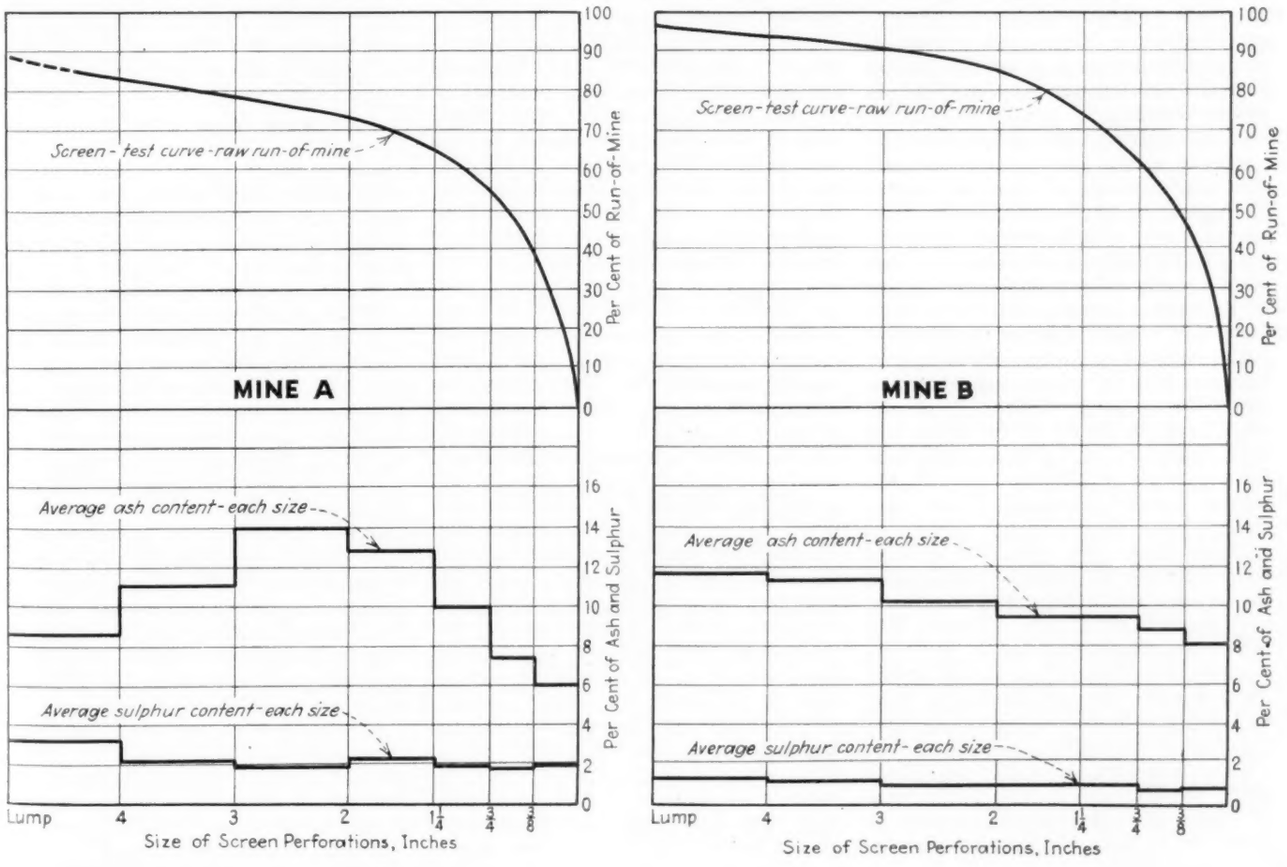
Consideration of the preparation of coal for commercial uses is concerned with:

1. Type and distribution of the impurities in the coal to be treated.
2. Specific-gravity distribution.
3. Chemical analysis.
4. Screen analysis.
5. Fusing temperature of ash and its composition.

On the basis of this, its amenability to improvement can be established, and, when properly analyzed, the correct method of preparation for the market can be determined.

The first factor of importance from the standpoint of improvement by prepa-

Fig. 1—Results of screen tests and ash and sulphur analyses of coals from two mines in the same region.



ration and cleaning is the character and distribution of the impurities in the coal bed. These impurities are mainly considered as being present in two principal forms: inherent and extraneous. The inherent impurities form part of the very character of the coal itself and are a part of the remains of the original plant life of which it was formed. Extraneous impurities, as considered here, are materials loaded with the coal, such as pieces of slate, rock and other foreign materials from without the seam, and composed of foreign matter which was deposited in the seam at the time of the coal formation, or the result of infiltration since. It is the extent to which the extraneous impurities can be removed which determines the amount of reduction which is possible in various coals.

Specific-gravity separations and chemical analyses do not show in which form the ash and sulphur and other impurities are contained in the coal; neither do they show the distribution of impurities according to the size of the coal, and a washability curve considered without this knowledge can be very misleading.

Ash Varies With Size

During the long period of time required for the formation of a coal bed the variable conditions then encountered often made strata of widely different characteristics and analysis within the seam itself. When these characteristics influence the friability of the coal, which they often do, it results in coals of various ash contents according to the size of preparation. This becomes readily apparent when the average ash content in each of the various sizes is projected on a screen test curve. For example, it will be noted in the case of Mine A in Fig. 1 (which shows graphically the results of screen tests and ash and sulphur analyses of coal from two mines in the same region) that the ash content increases with the screen size until it reaches the 3-in. perforation, at which point there is a sharp decline as the size of the lumps increase. On the other hand, the sulphur content of this coal varies slightly up to the 4-in. size, then increases with the increase in size of the coal. The product of Mine B, on the other hand, is regular in formation and is characterized by a comparatively uniform increase in ash content, with the sulphur content remaining almost constant.

While these two examples show a wide variation in impurity distribution, the average ash in the run-of-mine from both mines is practically the same. The ash in the coal from Mine A, however, is concentrated in such a way as would cause a wide variation in quality if it were shipped in different irregular combinations or mixtures.

From a preparation or cleaning standpoint, the high ash may be in the form of inherent ash or may be composed of good coal with heavy laminations. Knowledge of the character of the impurities and their distribution in the sizes is then of great assistance in determining the preparation which might produce a redistribution of the coal and refuse with a resulting better yield of coal and a higher ash reject.

Fusion temperatures and composition of ash also have taken on increased importance with the development of efficient combustion equipment and boiler construction. From a preparation standpoint, the fusion temperature of the ash is dependent upon the chemical and physical combination of elements of which it is composed and not necessarily upon the quantity of ash. In the blending and mixing of various sizes of different coals the fusion temperature does not change in proportion to the combined quantities, as it does with the percentage of ash, but is dependent upon the new physical and chemical proportions resulting from blending and mixing.

While these variables are not absolutely fixed, they can be determined, and, on the basis of this knowledge, proper preparation equipment can be arranged for so that prepared coal of a standard quality can be produced.

Coal-preparation equipment as manufactured today has been perfected to meet practically every requirement. To accomplish its purpose successfully, however, the equipment of each preparation plant must be of a type and so arranged as to suit each individual case. The many variables entering into the problem make it improbable that a preparation plant moved from another property, or purchased simply because similar equipment has been successful at another installation, can be entirely successful. The chances are that to do this will undoubtedly result in a sacrifice of the product or of its market possibilities, with an eventual loss which will be greater than the immediate minor savings which might be secured.

Matching Coal and Equipment

The addition of new equipment to an established plant is worthy of the same careful consideration. Many times the addition of a simple piece of equipment, which a manufacturer has developed and known to be correct, will prove unsatisfactory when purchased by an operator and installed in an established plant. So, too, a mine may have a piece of equipment working satisfactorily, but the same type of equipment when installed in an adjacent mine may give very poor results. In the first case all the various contributing factors were no doubt considered, whereas, in the second case, the equipment was merely installed.

From these limitations, however, it does not necessarily follow that a new preparation plant or the addition of cleaning or preparation equipment must be a large or complicated arrangement of mechanism. On the contrary, due to the type of service and the conditions under which it must operate, simplicity remains one of the prime factors of importance in the design and installation of coal-handling and preparation equipment.

The correct preparation of any coal is that preparation which can be economically made to fit the coal best for the market for which it is intended. This can be done, however, only on the basis of sound preliminary investigation which provides the information for proper design to meet the requirements. It is often a surprise to the operator to receive three or four designs for a contemplated plant, each one with a widely different proposed method of handling the problem. They may all be good, some may be better and some may even be too good for the work required. The result is confusion to the operator and a sudden realization that perhaps his own knowledge of the requirements was not very well defined before bids were requested.

Factors to Be Considered

There are many factors which influence the operation of a preparation installation, as, for example, the installation of a simple crusher, which is affected by:

1. Type of coal.
2. Ratio of reduction.
3. Permissible oversize and undersize.
4. Location of crusher.
5. Method of feeding.
6. Rate and uniformity of feed.
7. Diameter of roll or rolls.
8. Spacing of roll or rolls.
9. Speed of roll or rolls.
10. Tooth formation and spacing.

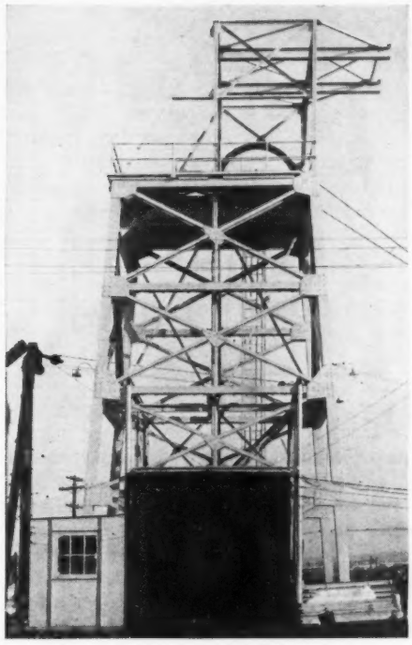
A disregard of, or incorrect application of, any of the above would be serious and detract from the good results which might be obtained. The same is equally true of other pieces of equipment which might be used or added to a preparation plant.

Good preparation today requires not only the consideration of how the coal is loaded at the plant but also of the condition in which it will arrive at its destination. Shooting in the mine which causes undue shattering can be just as much the cause of poor preparation as screening which does not remove the fragments barely clinging to the large lumps, or the fines which rightfully belong to a smaller grade. The difference between degradation and preparation is a tangible one which is becoming more and more recognized from the customer's standpoint. He is just as anxious to receive the coal he purchased in as good condition as possible as is the producer when he purchases his supplies.

The many developments in the preparation field during recent years, when properly applied, can greatly assist the operator in preparing and delivering to the customer a well-prepared coal of which he can be justly proud.

ANTHRACITE BREAKER

+ With Fresh-Water Cone, And Large Pockets for Retail Trade



Headframe, Clear Spring mine, with fan

FEW breakers better illustrate the new era in preparation than that erected for the Sullivan Trail Coal Co., at West Pittston, Pa. It replaces a structure built in 1882 by the Clear Spring Coal Co., which operated it until 1911. In it the coal was picked by hand by about 110 employees, and the output was 1,000 tons daily. Today only six men work inside the breaker, the output is larger, and yet the coal is better prepared. However, that is no new story, perhaps, though the number of men is unusually low. It is in the facilities provided, in its simplicity and in the excellence of the product that the breaker is outstanding. Also it is the first breaker to employ a recently developed cone-separator system for cleaning a wide range of sizes, using only two cleaning units, and it is the first to use such units to clean the entire product.

Generous Truck Space

The cone uses clean water, needs no rewashing facilities and is entirely accommodated on a single floor of the structure, giving ample room for large pockets below, for delivery of coal to both railroad cars and trucks with two lanes for trucks below the breaker and with only a single track for loading into railroad cars. Trucks, therefore, can be accommodated at all hours, even though the breaker is operated for only a single shift. Arrangements have been made so that the mine can run any number of shifts and the coal can be loaded unwashed as run-of-mine into railroad cars, to be discharged into the breaker hopper, during the running shift of the cleaning plant in any proportion desired. Hence, if the mine is running slow the coal from the cars will maintain the flow and keep the breaker working at capacity, thus affording conditions most desirable for economical and efficient coal cleaning. A mixing yard can be provided in the space between mine and breaker, so that uniformity of appearance, ash content and ash fusibility can be assured.

The breaker is located in Luzerne County, Pennsylvania, about 1,500 ft. from the right bank of the Susquehanna River. It receives most of its coal from the main shaft of the Clear Spring mine, which is located 454 ft. south. The distance from the shaft to the center line of the dump hopper of the scraper conveyor by which coal is lifted to the head of the breaker is 250 ft. Under the law the new structure had to be located not less than 300 ft. from the shaft, but it was made more, so as to leave plenty of room for storage of cars, permitting the coal from the various beds to be effectively blended and the delivery of coal to the breaker to be regulated both as to quality and quantity. The dump hopper receives coal on the west side, having a reciprocating feeder with several speeds, so that the quantity received from either source can be regulated to suit conditions.

For railroad-car and truck loading, eight 170-ton-capacity overhead storage pockets have been provided, an aggregate of 1,360 tons, but, if needed, with shoveling, as much as 1,800 tons can be accommodated. These pockets extend for a length of 72 ft. parallel to the loading tracks and are 54 ft. wide. Two Fairbanks track scales, each 50 ft. long, are located one immediately above and one below the breaker; the "light" scale is used to weigh the empty cars as they arrive and the "loaded" scale to weigh the loaded cars as they pass from under the pockets. The trucks are weighed in and out on the office scales.

Loading Boom for R.R. Cars

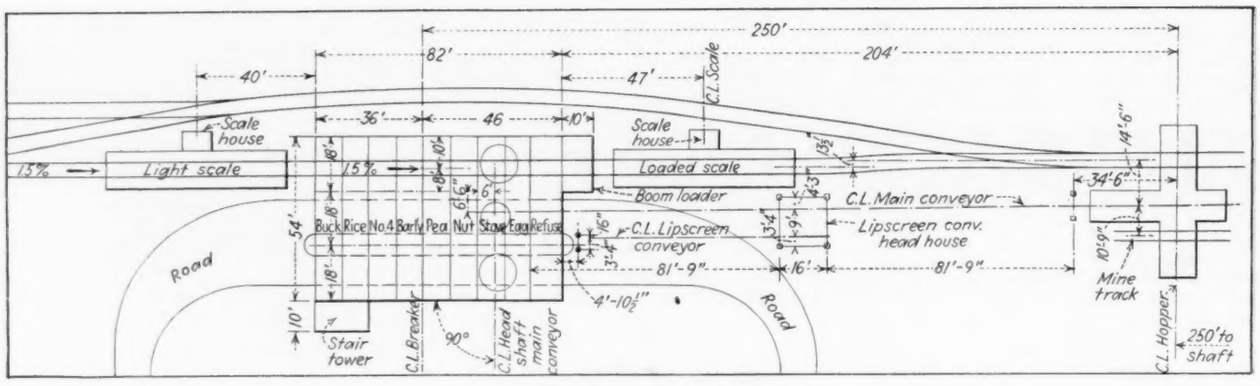
A loading boom, consisting of a flat belt 42 in. wide and having skirt boards, conveys coal from egg, stove, nut and pea pockets and deposits it with minimum breakage in the railroad cars. Other sizes—buckwheat, rice, barley and No. 4—are loaded direct by chutes. Fortunately, at this mine even the smallest of these sizes finds a ready market at a near-by point. Each storage pocket has two gates for railroad cars and two for trucks.

The 36-in. main flight conveyor, with a pitch of 6 in. to the foot, discharges onto a set of lump shakers which has three decks. Lump-and-steamboat remains on the top deck, grate coal falls onto the second deck, and the lowest deck is a blank carrying pan which receives all the smaller sizes. Lump-and-steamboat goes over a picking table reciprocated by the upper deck of the lump shaker and, after cleaning, passes to the No. 1 rolls, where the coal is broken to grate-and-smaller. This product goes to the grate shakers, where it joins grate from the second deck of the lump shakers. Here the oversize goes to the No. 2 rolls, where it is reduced to egg-and-smaller; this product in turn goes to the egg shaker—with egg-and-smaller from the lump shaker. Here egg is taken off the top deck and sent to No. 3 rolls. Here all or any part of the egg coal may be reduced to stove-and-smaller. Undersize from the egg shaker joins the coal from from No. 3 rolls, thus assembling the entire product received by the breaker, now reduced either to egg-and-smaller or stove-and-smaller.

Four Sizes in Each Cone

This coal now passes to a 4-deck feed shaker, where it is separated into four sizes: (1) egg-and-stove, (2) nut-and-pea, (3) buckwheat-and-rice, (4) barley-and-No. 4. Egg-stove-nut-and-pea goes for cleaning to a Menzies cone separator of 12-ft. diameter, constructed by the Koppers-Rheolaveur Co., and buckwheat, rice, barley and No. 4 buckwheat to a similar 10-ft. unit. The principle on which these cone separators operate was fully described in the February, 1935, issue of *Coal Age*, p. 59.

Overflow from the 12-ft. cone is discharged to four decks of shaking screens, 7 ft. and 8 ft. wide by 18 ft. long, to re-



Plan of breaker and receiving hopper

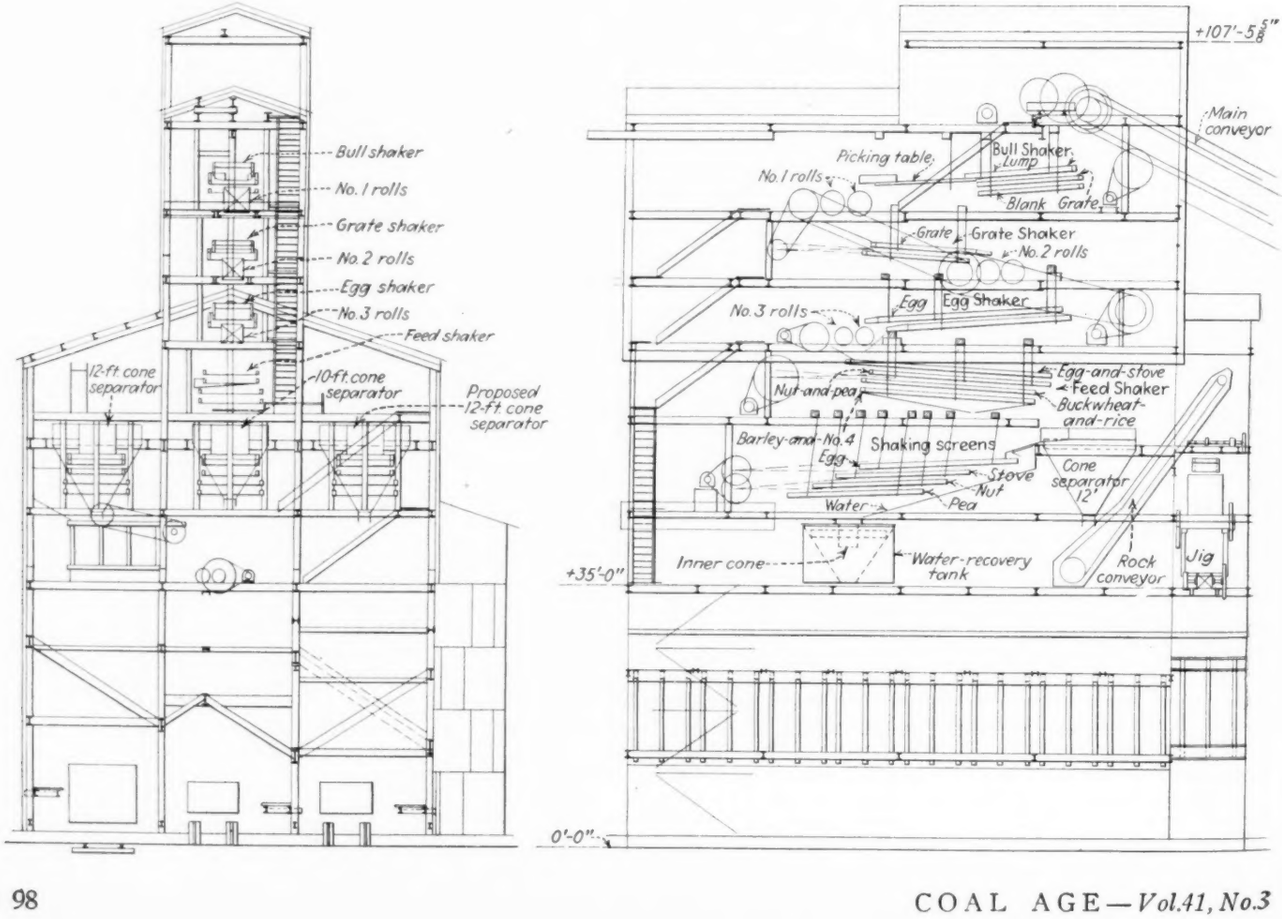
move the water that overflows with the coal and to divide the coal into its four component sizes. From the discharge ends of these screens it is deflected and passed, duly cleaned and sized, to the several pockets. Similarly, the overflow from the 10-ft. cone is discharged to four decks of screens, 7 ft. and 8 ft. wide and 18 ft. long. These screens remove overflow water and divide the coal into buckheat, rice, barley and No. 4.

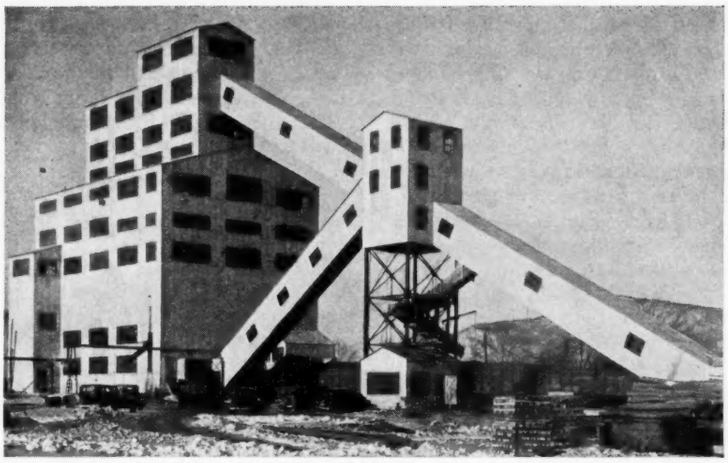
Water from beneath the prepared-size screen travels to a water-recovery tank having an inner cone wherein the solids settle. These are flushed out and returned to the breaker feed; similarly, water from the steam-size screens goes to another water-recovery tank with a similar inner cone; these solids settle but are flushed out with the waste water from the breaker. Pumps recirculate the water from both these tanks through the cone separators in which the coal is washed. Refuse from the cones is automatically discharged through their bottom necks into rock conveyors.

That from the larger cone, which ranges from egg to pea in size, is delivered by its rock conveyor to a refuse Wilmot jig which separates good bone and cappy coal from the heavy refuse. It constitutes 15 to 20 per cent of the jig input or about 2 per cent of the egg-stove-nut-and-pea feed passing to the 12-ft. cone. The light material, which has coal values, is passed through a bone roll that produces pea-and-smaller. This product is returned to the breaker feed for recleaning.

Heavy refuse from the jig passes to the rock pocket, where it is removed by trucks to the refuse bank. Refuse from the smaller cone, which ranges from buckwheat to No. 4, being of no value, goes direct to the rock pocket. Along the scraper conveyor feeding the breaker is a tower with provision for diverting unwashed run-of-mine coal to railroad cars. This was used for shipment to an outside cleaning plant before the breaker was completed for loading coal. It is now

Elevations of Sullivan Trail breaker





Sullivan Trail breaker, West Pittston, Pa., caters to truck and railroad trade

being used to stock coal in railroad cars when the breaker is idle.

Breaker and conveyors are steel-frame structures on concrete foundations; flooring and pockets are of plank. Roofing is of corrugated steel with 2-oz. zinc coating; window openings are corrugated galvanized steel with steel sash having ventilator sections. The entire breaker is electrically driven, with V-belt drives from motors to the pulleys of the several units. The breaker is equipped with electric lighting for continuous night operation. Both breaker and conveyor structures are furnished with unit heaters and stationary pipe radiation.

Provision for Future

Rated at 1,200 net tons in 8 hours, the breaker has cleaned 1,500 tons in that period, and the management believes it could handle 2,000 tons. At present the output of the plant is about 1,500 tons daily with the mine running double-shift. However, space has been provided for another 12-ft. cone separator for the prepared sizes, the 10-ft. cone being large enough to take care of the smaller sizes, should a second 12-ft. cone separator be installed. The capacity of the breaker will then be much over 2,500 tons per day of 8 hours. One man operates both the present units; one man is stationed on the picking table. In all, only six men are employed inside the breaker.

Clear Spring mine concluded its work in 1911 with all the thinner beds unmined, and indeed with much of the thicker coal also still in place, for, with the facilities then available, it had been found difficult to keep these sections of the coal seams free of water. Today, with the aid of machinery the thinner coal can be removed without taking down the roof in chambers and, therefore, is readily workable. Pumping improvements also greatly decrease the problem of drainage, making reopening profitable.

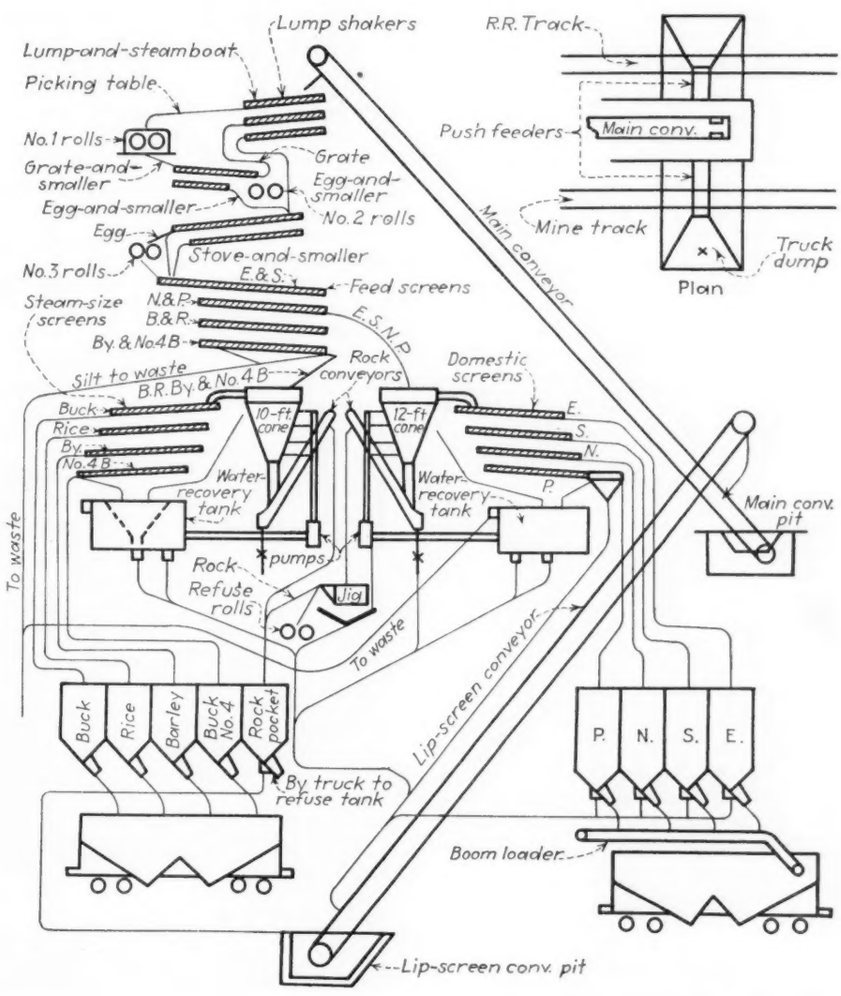
The coal basin has its regular anticlinal and synclinal folds, but it also has some humps and hollows that are less systematic; these probably are older than the main folding and definitely related possibly to the splitting of the coal beds, though as to this no evidence is as yet forthcoming. These humps and hollows caused the former management to leave much virgin coal in the Checker and Pittston beds. The other beds have been worked not at all or only locally. The cross-section would include the Checker bed (110 ft. below the shaft collar), the Pittston (150 ft. below that same datum), the Marcy, the Clarke and the three Red Ash beds. The lowest of the beds is 450 ft. deep, and the shaft extends to this bed, but has not been cleaned of culm below the Pittston measure.

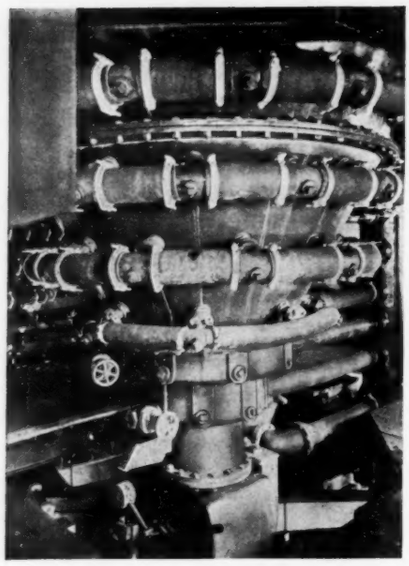
The Pittston bed is split at the shaft and is 5 ft. thick in the upper split and 3 ft. in the lower, with the two about 20 ft. apart, but at a point about 300 ft. to the south the two splits come together. The usual thickness of the Checker is 9 ft.; of the Pittston, 10 ft.; and of the Marcy, 12 ft.

When work at the old operation was concluded, the shaft was filled with culm so completely that its actual location was in doubt. Removal of this material constituted one of the difficult problems of the company, as there was not only culm but much water to be removed as soon as a depth of 120 ft. was reached.

Before a headframe was erected it was essential to know whether the roof had broken through the measures to the Susquehanna River. Some believed that such a break had occurred or was, at least, probable. If there had been such a break, it would not have been possible to locate

Flowsheet, showing flow of coal, refuse and water





Side view of separator with its bustle pipes

it, and the inflow of water would have been beyond control. Consequently, an exploratory borehole was drilled which struck water at 120 ft. below the level of the shaft collar. The pumps readily were able to lower this water another 20 ft. At the shaft the excavation of the culm proved that there also the water was at the level in which it was found in the borehole. So it appeared that the water in the two locations was connected and was controllable. As the Susquehanna River was only 35 ft. lower than the shaft collar, it was clear that if there was a leak from the river, the water must be going to other mines, which were handling it, or there was no leak at all, certainly none of any moment. In fact, the mine nowhere reaches within 100 ft. of the river. So the company felt warranted in proceeding.

Even if the mines adjacent were getting Susquehanna River water from the Clear Spring mine, the reopening of those workings should not be difficult, as the pumps of the other mines and of the Clear Spring mine should be amply able to control the water if the pumps in the other mines alone had been able to keep it from rising above a point 120 ft. below the shaft collar. But still to play safe, and because the shaft might cave and let in unmanageable volumes of water, even then the headframe was not erected.

A stiff-leg derrick and a ¾-cu.yd. clamshell bucket were used with two counterweights and guides. The counterweights almost balanced the bucket, leaving just enough excess weight to enable it to fall gently into the pit. Fortunately, the timbers were in good condition after the long interval, possibly because they had not been exposed to the air. Two 4,000-g.p.m. pumps were provided which were slung in the shaft, one working while the other was being lowered. In this way the water did not gain headway between pump lowerings. The sinking being completed, a steel headframe was erected.

All the flat lands around the shaft are covered by the celebrated Buried Valley débris, so rock did not appear until a depth of about 80 ft. was reached. However, the Buried Valley detritus is not 80 ft. thick at the shaft, as the ground had been raised at that point so as to provide a fall to the breaker hopper, and in the operation of the old breaker some material had been deposited at that location. The shaft was of adequate dimensions, so that it was possible to put in a lining of reinforced concrete within the old lining and still leave ample space for cages and cars, the air-and-pump compartment occupying a space at the western end. One of the 4,000-g.p.m. pumps is slung at the foot of the shaft and removes sump water and the other has been taken to the bottom of the dip and now feeds to the sump.

The main haulway in the Checker bed has been cleared for 3,500 ft., and a tunnel will be constructed from the Checker to the Pittston, so that all the coal from the two seams can be hauled to the Pittston pit bottom. None of the chamber pillars will be removed, because West Pittston lies above the mine workings and neither the lessor, which is the Clear Spring Coal Co., nor the lessee desires to disturb the surface.

Moreover, the Buried Valley has quicksands which would run into the mine and might let in Susquehanna River water. Careful and frequent drilling guards against this eventuality.

Coal is loaded in rooms of varying widths, depending on roof strength, into shaking conveyor pans actuated by La-Del drives, which in some cases deliver direct to the mine cars and in some places to rubber belts, which concentrate the coal received from several places. As the roads are laid in the centers of the chambers, and the latter are 20 ft. wide or less, the shoveling distance is such that no coal has to be handled twice.

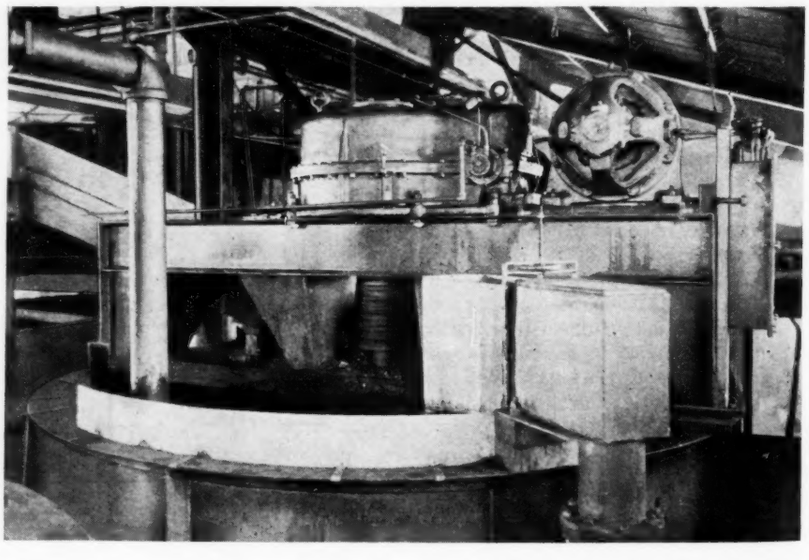
Cars hold four tons with a 12-in. topping. These are of wood and have Timken roller bearings. Dimensions of cars are: over-all length, 11 ft. 6 in.; over-all width, 5 ft.; over-all height, 4 ft. 2 in.; wheel diameter, 16 in.; wheelbase, 3 ft.; bed capacity, 110 cu.ft.

Coal cars are handled by two hoists, one which lets the loaded cars down in the dip and raises the empty cars, and another which reverses the operation, letting down the empties and raising the loads. The gradients are too heavy for locomotives. Some mules are employed.

The hoist at the surface was originally steam-operated, but, by cutting away the pedestals and moving the drums forward, space was provided for gear reducers, and a motor was installed to operate the hoist. All the water is neutral and so is well suited for use in the breaker. The water was lifted in two 14-in. lines and delivered to another 18-in. line which carried it to the river. The three-way connection later was changed to a four-way connection so that water could be delivered to the breaker also, using a 14-in. line. The air enters the mine by the two hoisting compartments and by the auxiliary shaft, courses through the workings and leaves by the airway compartment. A 10-ft.-10-in. Aerovane fan which is capable of delivering 178,000 cu.ft. per minute at a 2-in. water gage and which is set on the west side of the airway compartment exhausts air from the mine.

All coal is drilled by compressed air and shot by Monobel explosive, and 325 Edison electric, type K, storage-battery lamps are used for lighting. The mine is supplied with a.c. current at 440 volts. Louis Pagnotti is president of the company.

Top of cone separator



POWER IMPROVEMENTS

+ At Harwick Coal & Coke Co. Mine

Boost Working-Face Voltages

By C. T. BLACKMORE
Pittsburgh, Pa.

VOLTAGE at the working face has been increased from an average of 120 to an average of 217 and minimums have been raised from 65 to 202 volts as the result of improvements made in recent years in electric power facilities and distribution at the Harwick mine of the Harwick Coal & Coke Co. This operation, at Harwick, Pa., is in the Thick Freeport seam; the coal lies 200 to 300 ft. below the surface, and the mine is rated as gaseous. Openings consist of a main shaft and an air shaft at Harwick and a second air shaft at Kissick Farm, about 1.5 miles (air line) from the main shaft.

All power used inside the mine is direct current supplied at 275 volts by motor-generator sets located on the surface. The motors used underground are rated at 220 volts. Power for equipment on the surface, such as the ventilating fan motor, the hoist motors, tipple motors, motor-generator sets, etc., is distributed at 2,300 volts, 3-phase from an indoor substation located adjacent to the main shaft.

At the time the improvements were started, the working faces were from 1.5 to 2 miles through the mine entries from the substation at the main shaft (see Fig. 1). Average operating voltages at the working faces were as low as 120, with minimum of about 65 volts. These voltages were so low that production was seriously limited and maintenance on the electrical equipment was high. The first column of Table I shows the voltages at various locations in the entries before the improvement work was started.

The improvement program was divided into four steps:

I. Installation of a new substation at the Kissick air shaft and reconditioning the existing distribution system in the mine to permit of an immediate increase in production.

II. A comprehensive study of the present and future load and voltage requirements of this mine, following which a tentative plan for the growth of the distribution system was set up.

III. Certain improvements, based on this study, were made to the distribution system.

IV. Installation of a new remote-controlled automatic substation to feed the southwest section of the mine.

Average operating voltage under load conditions at the most distant working faces after the completion of this improvement program was about 217 volts, with a minimum of about 202 volts.

The results obtained by these improvements bring out clearly the importance of the following principles of design:

(1) That the substations should be located as near the load centers of the mine as is practical.

(2) That small-capacity remote-controlled automatic substations of a type which can be easily and economically moved from one location to another and which do not require an attendant are often more desirable than large substations which are not easily moved.

(3) That the distribution system in the mine should be given careful attention to assure: (a) that the resistance of the system is low enough to give adequate voltages at the working faces under load conditions; (b) that the resistance of the negative side of the system is kept somewhere near that of the positive side; and (c) that the system is so arranged that it can be easily and economically altered so as to continue to serve the working areas as they move further and further from the entrance of the mine.

(4) That multiple and supplementary bonding are the most economical ways of reducing the resistance of the negative side of the distribution system.

Power facilities in use at the time the improvements were started (1926) were typical of those usually found in the better of the older mines in western Pennsylvania. They consisted of a single motor-generator substation located on the surface at the main shaft and supplying power at 275 d.c. over two positive feeders to a distribution system inside the mine. Energy for operating the substation was supplied at 2,300 volts, 3-phase, by the Duquesne Light Co. from an outdoor substation located adjacent to the main shaft. This outdoor substation is fed by two 22-kv. lines equipped with automatic reclosing breakers, thus reducing the chance of power failure due to line trouble. Only one bank of transformers is used, as operating experience has shown that transformer failure is very unlikely to occur.

The motor-generator substation at the main shaft contained two 300-kw. and two 150-kw. motor-generator sets composed of 2,300-volt synchronous motors and 275-volt two-wire d.c. generators, together with the oil circuit breakers for the 2,300-volt a.c. switching and the control panels for the breakers, motor-generator sets and feeders into the mine. The two positive feeders from the substation entered the mine through a borehole about 220 ft. deep. Each consisted of a 1,000,000-circ.mil insulated lead-covered cable connected to a separate circuit breaker in the substation and to the distribution system in the mine by knife switches located at the bottom of the borehole.

There was only one negative feeder from the substation. This feeder consisted of a single 1,000,000-circ.mil insulated lead-covered cable and entered the mine through a separate borehole. It was connected solidly without switches to the negative bus in the sub-

station and to the negative side of the distribution system at the bottom of the boreholes, and also solidly grounded in a creek bed adjacent to the top of the borehole. The positive side of the distribution system consisted of the trolley wires. In a few of the main haulageways, insulated cables mounted on insulators along the ribs were connected in parallel with the trolley wire. The negative side of the distribution system consisted of the tracks in the haulageways. Only one rail of these tracks, however, was bonded through and that with only one 4/0 bond at each rail joint. Cross bonds, however, were installed at intervals of not more than 200 ft. (Fig. I shows the location of the substation, distribution system, and working faces when the improvement program was started.)

The improvement program was started to enable the mine management to meet an increased demand for coal. This increased production was required in two months, so no time was available for an extensive study. It was decided to obtain this increased production by opening up a north section of the mine. The design of the first step of the improvements, therefore, included only the betterments necessary to permit development in the north section. This improvement consisted of:

(1) Moving one of the 300 kw.-motor-generator sets in the substation at the main shaft to a new substation located on the surface at the Kissick air shaft (see Fig. I).

(2) Running the positive and negative feeders from this substation down the air shaft and through one of the main butt entries, where they were connected to the existing distribution system. Bonding the second rail of the tracks in the main haulageways with one 4/0 bond at each rail joint.

(3) Reconditioning the existing rail bonding.

(4) Installing additional positive feeders in certain of the main haulageways to increase the current-carrying capacity of the main part of the power-distribution system in the mine and installing supplementary bonding on the tracks in the same sections.

While designing these improvements it was discovered that a large quantity of second-hand feeder cables of 500,000 and 1,000,000-circ.mil sizes was available at scrap prices. So a method was developed for reducing the resistance of the negative side of the distribution system by using these second-hand cables as a supplementary bonding system to the rails at an estimated cost very much less than that of installing new insulated negative feeders (see Table II). This supplementary bonding system consisted of a copper cable installed along the haulageway adjacent to the tracks and solidly connected to the rails of the track at 8- to 10-ft. intervals.

This gives a negative path consisting of two rails of the tracks and a copper cable all in parallel and tied together at short intervals by the cross bonding of the rails and the connections to the copper cable, thus making it impossible to interrupt the negative path without breaking the path along each bonded rail as well as breaking the additional copper cable. It is evident that any breaks in the copper cable will not interrupt the circuit but will only increase its resistance slightly, and that at no point will there be sufficient voltage across a break in the cable or a break in the rail bonding to sustain an arc and cause fire or to injure a person by electric shock.

Average operating voltages at the more distant working faces of the mine were increased by the installation of these improvements from about 120 to about 185, with minimum of about 165 volts. Details of the voltage at various locations in the entries of the mine as measured after the completion of the first step of the improvements are shown in Table I. The management was able to increase production to the desired figures and the cost of maintenance was greatly decreased as a result of the improvement in voltage obtained.

Fig. 1—Distribution system and working faces after completion of first step in improvement program

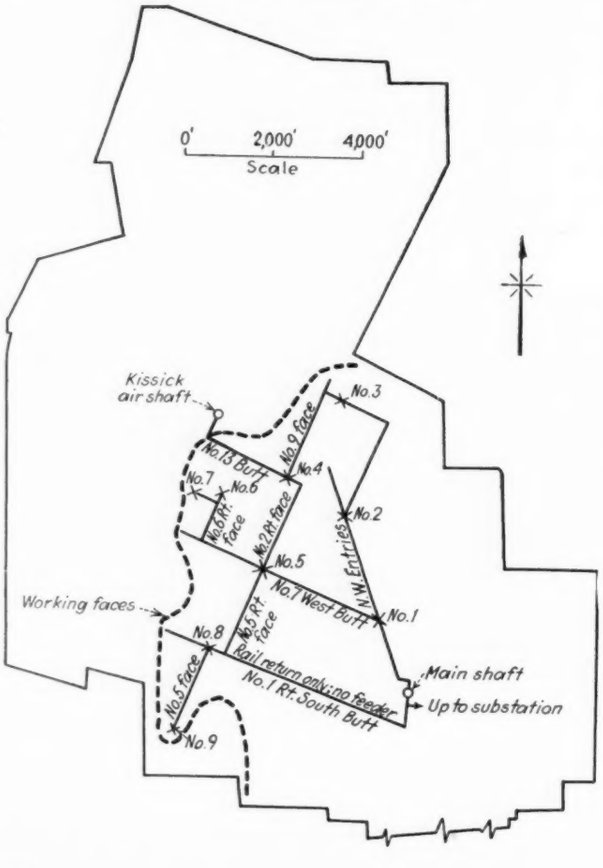


Fig. 2—Distribution system and working faces after completion of second step in improvement program

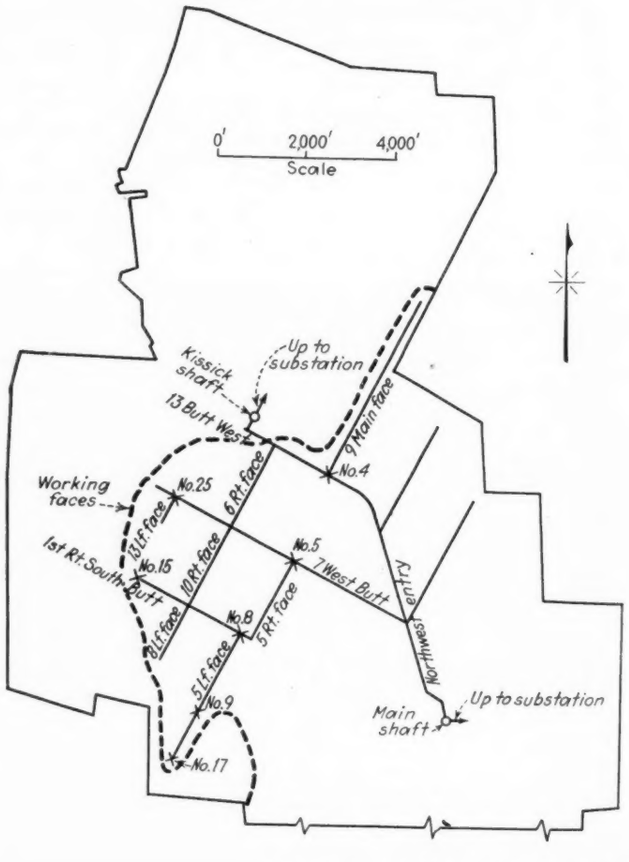


Table I—Comparison of Average Operating Voltages Under Load Conditions in the Entries Before and After Installation of Each Step of the Improvement Program

(Note: The voltages at the working faces are about 25 volts lower than in the entries, due to the drop in the cable connections to the machines.)

Station No. (See Fig. 3)	Location	First Step		Third Step		Fourth Step		
		Before	After	Before	After	Before	After	
							Kissick On	Kissick Off
1	Junction of Northwest Entry and 7 West	246	260	240	255	255	255	255
3	5 Left Face off 5 Face near 10 Face	170	205	This station in worked-out area.				
4	13 Butt left off 2 Face at 9 Main Face	227	265	260	260	260	260	235*
5	2 Face off 7 West	206	230	247	250	250	250	250
6	6 Face Right off 7 West at 5 Butt left	160	220	This station in worked-out area.				
7	3 Butt left off 6 Face	146	215	This station in worked-out area.				
8	At 5 Face off 1st Right South	190	260	210	225	225	245*	235*
9	5 Face off 1st Right South 2,000 ft. out	168	210	220	220	220	242	235
15	1st Right South at 13 Left Face	Not developed		235	255	255	260*	260
16	8 Face Left off 1st Right South at 7 Butt lf.	Not developed		210	250	250	260	260
17	5 Left Face off 1st Right South at 16 Butt left	Not developed		210	215	215	242	230
25	7 West at 13 Face	Not developed		220*	225	225	245	225*
30	9 Main Face at 32 Butt	Not developed		240*	240	240	240	No reading
31	Out 750 ft. on 10 Butt lf. off 5 Left Face off 1st Right South.	Not developed		Not developed		210*	260*	227
33	1100 ft. out 10 Left Face off 1st Right South	Not developed		Not developed		190*	260*	260
34	7 West at 15 Left Face	Not developed		Not developed		220*	245	226
36	At 3 Butt off 11 Right Face off 7 West	Not developed		Not developed		215*	245	210

*No readings were made at these points. The values given are estimated from readings made at adjacent locations.

Note: The second step in the improvement program was a study of present and future load requirements and the setting up of a tentative plan for growth in distribution system.

II About eighteen months after the completion of the first step of improvements, it was decided to make a comprehensive study of the future load and voltage requirements of this mine and set up a tentative plan for the growth of the distribution system which led to the following recommendations:

(1) That the resistances of the distribution system be so distributed that the energy from the substations would be delivered at the rooms in the working faces at not less than 200 volts. It was further recommended that the resistance of the positive and negative sides of the feeders from the substations and of each section of the distribution system be kept at approximately the same value.

(2) That the distribution system in the mine be arranged so as to form a network into which the substations feed and from which short radial feeders would extend out into the various entries leading to the working faces (see Fig. 2). It was further recommended that this network be arranged so that portions of it might be relocated from time to time as the load centers followed the development of the mine.

(3) That an additional substation of the remote-controlled automatic type be installed to feed into the southwest section of the distribution system when the southwest and west sections were put under heavy production.

Fig. 3—Distribution system and working faces after completion of fourth step in improvement program

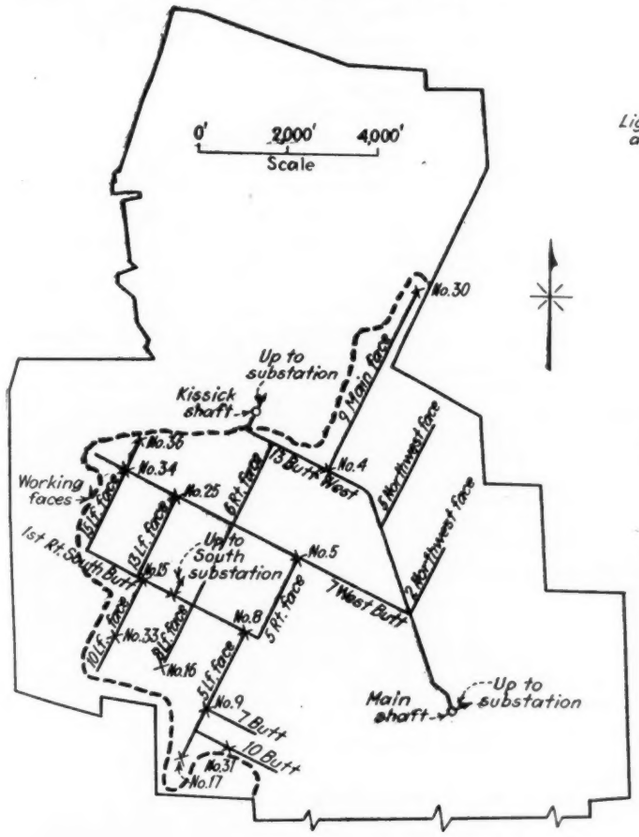
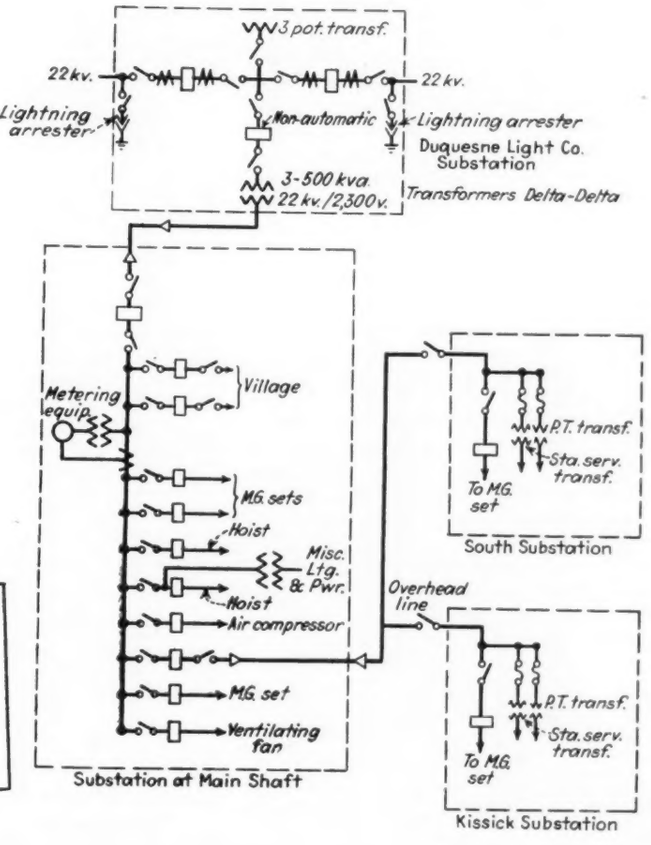


Fig. 4—Single-line diagram of alternating current service at Harwick mine as operating in 1935



While making this study estimates showed the resistance of the negative side of the distribution system could be reduced by installing multiple bonds at each rail joint of the tracks to a value not more than 10 to 12 per cent higher than the sums of the resistances of the rail lengths at a lower cost than by installing insulated negative feeders of the proper size to give the same reduction in resistance. Calculations showed that the following bonds would be required to give this reduction:

One 4/0 bond 14 in. long for each 25-lb. rail.

One* 4/0 bond 14 in. long for each 40-lb. rail.

Two 4/0 bonds 14 in. long for each 60 and 70-lb. rail.

III Improvements recommended in (1) and (2) above were installed shortly after the completion of this study. Resistance of the positive side of the distribution system was reduced by installing about 24,000 ft. of new positive feeders in parallel with the existing trolley wires in various haulageways. Most of these new positive feeders were used to extend existing feeders further out into the mine, but a portion of them was used to complete parts of the network making up the main part of the distribution system. Safety-type non-fusible disconnecting switches were installed in the positive feeders at junction points to make it possible to clear any section grounded by a roof fall or other trouble.

Resistance of the negative side of each section of the distribution system was reduced to a value not greater than the resistance of the positive side of the same section by installing multiple bonding, as indicated above, on the rails and where necessary to get further reduction by installing supplementary bonding as described above. An additional 1,000,000-circ.-mil cable was added to the negative feeder from the substation at the main shaft into the mine.

Completion of these improvements resulted in increasing the average operating voltage under load conditions at the more distant working faces of the mine from about 185 to 200, and increasing the minimum voltages under load conditions from about 155 to 173. Columns 3 and 4 of Table I give details of the average operating voltage at various locations in the entries of the mine as measured before and after the second step of the improvements were installed. Fig. 2 shows the location of the substation distribution system and the working faces after the installation of the third step of the improvements.

*A second 4/0 bond was installed on the 40-lb. rails in the haulageways as a factor of safety so that a failure of one bond would not cause a large increase in the resistance of the return path. This second bond was not considered necessary on the 25-lb rails, which are used only in short lengths of temporary track and are not called on to carry large currents.

Table II—Comparison of Cost of Positive Feeders and of Supplementary Bonding to Give Same Reduction in Resistance of Circuit

Size of Feeders	Cost of Positive Feeders per 1,000 Ft.*	Cost of Supplementary Bonding per 1,000 Ft.*
1 4/0 B & S.....	$435	$310
1 500,000†.....	665	410
1 750,000†.....	925	600
1 1,000,000†.....	1,145	710

*Based on actual construction costs in 1928. †Circ. mil.

IV About one year after the completion of the above study it was decided to concentrate production in the southwest section of the mine, and work was started on the installation of the new substation recommended under (3) above. This substation, known as the South Substation, is of the remote-controlled automatic unattended type and contains one 300-kw. motor-generator set equipped with the usual protective devices found in automatic substations. It was designed to be easily and economically movable to other locations. The building is a factory-built portable-type steel building. None of the conduit or other equipment except the anchor bolts for the motor-generator set is embedded in the concrete foundations. When it is desirable to move the substation to a new location the foundation will be the only part which cannot be easily moved and used.

As installed this substation is located at the top of a borehole leading to one of the main entries in the southwest section of the mine about 1.75 miles through the haulageways from the main shaft. It is fed by a 2,300-volt three-phase feeder from the substation at the main shaft, thus combining the demand of this substation with the other load at Harwick, and saving the service charges of a separate high-voltage connection to the Duquesne Light Co. system. After this substation was installed it was decided to stop all work temporarily in the north section of the mine and to hold the substation at the Kissick air shaft in reserve for use in case coal requirements made it necessary to resume operations in the north section on short notice.

Average operating voltage at the more distant working faces in the mine after the installation of the South Substation was increased from about 165 to 217. The minimum voltage under load conditions was increased from about 135 to about 210. Details of the voltages at various locations in the entries of the mine before and after these improvements were made are shown in the last three columns of Table I. Fig. 3 shows the location of the substations distribution system and working faces when the program was completed. Table II gives a comparison of the cost of reducing the circuit resistance by installing additional cable in the positive or negative and the cost of getting the same reduction by installing the supplementary bonding as previously described. Estimates show that about $18,000 was saved in the cost of the improvement work on the distribution system in the mine by using multiple bonding and supplementary bonding instead of by installing additional feeders.

More Mines Opened

Still further increasing the margin in favor of additions to bituminous-coal-producing capacity since Jan. 1, 1933, as compared to capacity taken out of service, twelve additional new mines and four reopened operations have been reported since the publication of the *Coal Age* survey in the February, 1936, issue, pp. 73-75. Aggregate capacity of these additional operations, listed in the accompanying table, is 5,370 tons per day. This compares with a total capacity of 2,530 tons per day represented by the six additional closings reported during the same period. By States, these closings are: Colorado—one mine, 1,200 tons per day; Illinois—one mine, 450 tons per day; Maryland—one mine, 250 tons per day; Oklahoma—two mines, 380 tons per day; West Virginia—one mine, 250 tons per day.

As a result of these additional reports, the revised total of new or reopened mines stands at 288, with an aggregate daily capacity of 179,245 tons. The revised total of closed or abandoned mines stands at 316, with an aggregate daily capacity of 161,450 tons.

New Mines

Company or Mine	Mine Address	Daily Capacity
Bear Coal Co.	Somerset, Colo.	150
Hawks Nest mine	Somerset, Colo.	100
Elk Horn Coal Corporation, No. 2	Fleming, Ky.	1,000
Wellston No. 2 Co.	Wellston, Ohio	1,200
Oklahoma Smokeless Coal Co.	Bokoske, Okla.	100
Premium Smokeless Coal Co.	Bokoske, Okla.	120
Cedar Ridge Coal Co.	Cedar, Utah	150
Monay mine	Scofield, Utah	...*
Beamer Pocahontas Coal Co.	Hensley, W. Va.	50
Berthy Coal Co., No. 2	Tioga, W. Va.	400
Green Smokeless Coal Co.	Cheat Junction, W. Va.	500
Pardee & Curtin Lumber Co., No. 4	Bergoo, W. Va.	200*

Mines Reopened

Horace mine	Crested Butte, Colo.	200
W. A. Ream Coal Co., Spanish Peaks (Strong) mine	Tioga, Colo.	600
Treco Smokeless Coal Co.	Rockwood, Pa.	...*
Utacarbon (Mutual No. 2) mine	Rains, Utah	600

*In development.

BRITISH WELFARE FUND

+ Provides Amenities for Miners

From a Tax on Royalties and Output

By R. DAWSON HALL
Engineering Editor, Coal Age

FUNDS for the construction of suitable places for the health, recreation and instruction of mine workers and their families are provided in Great Britain by two taxes on coal. With these, magnificent bathhouses, canteens, and covered parking spaces for the cycles on which the mine workers arrive for their work have been constructed; sites also for playgrounds, small parks and summer camps have been acquired, and many ingenious and delightful facilities provided for recreation and shelter for those of all ages, including those of declining years; hospitals and convalescent homes have been erected and furnished with necessary equipment; ambulances have been purchased, "institutes," or recreational centers, with swimming baths, dance floors, stages, card rooms, billiard and other play rooms, reading rooms and libraries have been built and equipped; lectures on vocational and non-vocational subjects have been provided; research into safe operation has been conducted; and promising youths have been sent to colleges and universities.

Mindful that one of the taxes, that on output, increases the price of coal and so hampers foreign trade and also raises the cost to the consumer, Parliament has recently reduced that impost. Thus far no other industrial workmen have been afforded similar facilities by a tax on their production. This article will deal solely with administration of the fund. Other information will appear in further articles on this subject.

When the British Coal Industry Commission of 1919, known generally by the name of its chairman, Justice Sankey, as the "Sankey Commission," reported in March of the following year, it recommended that every ton of coal produced should contribute 2c to improve the housing and amenities of each colliery district. Under Sec. 20 of the Mining Industry Act of 1920, the levy suggested was laid on all coal produced in Great Britain, but improvement of housing was not among the purposes sought. Proceeds from the fund thus created were to be applied to the social well-being, recreations and living conditions of workers in and about coal mines and to mining education and research, as the Board of Trade (a national governmental institution) might approve, after consulting all government departments concerned.

Originally the collection of the Output Welfare Levy, as the tax on tonnage was termed, was restricted to the period between July 1, 1920, and Dec. 31, 1925, but it was extended by two Mineral Industry (Welfare Fund) acts for a further five years. This tax was reduced in 1934 to a single cent per ton, at which time its operation was extended over another 16-year period.

Meantime, in 1926, as the outcome of a recommendation of a Royal Commission functioning under the chairmanship of Sir Herbert Samuel, a 5-percent levy was placed upon royalties for the express purpose of providing funds for the erection of bathhouses, but this fund may be and has been supplemented by funds from the output levy. In the enactment of 1924, it was directed that the fund for bathhouses receive from the output tax receipts enough money to raise the fund to $1,824,947* annually and that $97,330 be applied to research into methods for improving health and safety of workers in or about coal mines.

During the life of the Miners' Welfare Fund from 1920 to July 31, 1935, $64,035,691 has been received from the output tax plus interest, and $9,630,871 from the royalty tax also plus interest, or $73,666,562 in all. This is practically all that has been received to date if interest of funds in hand is added, for the tax becomes due March 31 of each year and covers the levies of the previous year.

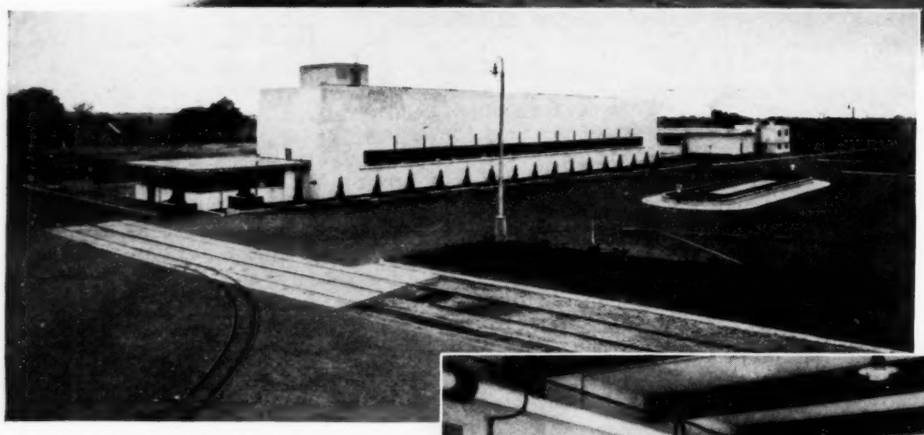
No salaries are paid to the Miners' Welfare Committee which controls the fund and consists now of nine persons, its numbers having been increased from five by successive acts. Three represent the miners, two the mine owners and one the royalty owners, who are

★ ★

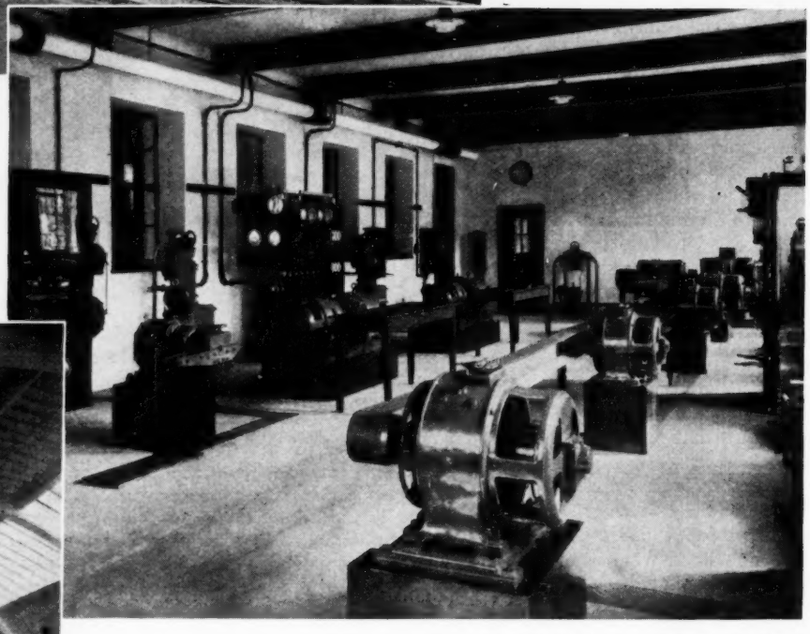
• Bathhouses and other facilities for miners are provided in the United States by coal operators out of their own funds. The laws of most of the States make bathhouse construction obligatory when a sufficient percentage of the men employed express a desire that they be provided. In Great Britain, however, bathhouses are built from taxes levied on the output of coal and on the royalties collected, and the construction of these bathhouses is subject to the approval of a central committee with competent advisers which supervises and, in a large measure, dictates what form of construction shall be adopted. The same applies to other forms of facilities provided, such as clubhouses, recreational facilities, ambulances, hospitals, convalescent homes, higher education in all lines and research into mining safety, all being provided from the special taxes or levies described. Difficulties exist in the apportionment among projects of the inadequate funds available and in providing for the necessities of small communities of miners, for the per-capita service when distributed among a few is unduly high. Also it is found impossible to provide such facilities where the life of the mining operation does not promise to be sufficiently long to justify the cost.

*In this and in similar cases $4.8665 has been considered as the equivalent of the pound sterling, though the relation between the currencies of the United States and Great Britain have varied considerably in recent years.

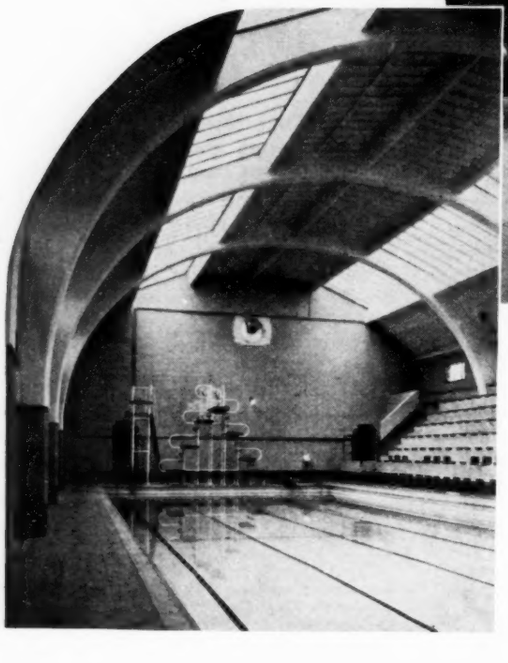
Coatbridge
technical high school,
Lanark



Coventry colliery pithead baths



Electrical laboratory at Coatbridge



Interior
Sherwood swimming pool

appointed, after consultation with the national bodies concerned, by the Secretary of Mines, who also appoints a chairman and two other members, one of whom at present is a doctor of medicine and the other an architect.

This committee is assisted by three assessors or technical advisers, appointed by the Ministry of Health, the Board of Education and the Secretary for Scotland, who have the right of attending meetings but do not vote. Though neither Welfare Committee nor assessors receive pay, they are permitted to collect from the fund for expenses incurred for traveling and subsistence while attending meetings or performing other duties connected with their work.

One-fifth of the output-levy fund after deduction for supplementing the bathhouse fund and for research as hitherto outlined goes to a general fund and the other four-fifths to a district fund. Each of the 25 districts into which the mining area is divided has its district committee, a body which, while regarded as advisory, really sets up its own welfare projects and submits them to the Miners' Welfare Committee for approval. It was the intention of the framers of the legislation that the district committees should represent only a single pit or a group of adjacent pits and that these should consult with the central committee of the district, but, as these local committees could not be arranged, the larger grouping alone was constituted; nevertheless, the right for each group or community of miners to apply for a grant still exists, and each project is devised by a joint local welfare committee of miners and operators who appoint joint trustees for holding the property. The local committee applies to the district committee, which, if it approves of the project, recommends it to the central committee for its approval or revision.

Technical Advice Provided

These central district committees soon found need for technical advice. Those in two of the larger districts, South Wales and Lanarkshire, secured systematic help from a private institution of experience, the Industrial Welfare Society. Later this branch of the society was incorporated in the staff of the Miners' Welfare Committee and put under its control, and it has proved quite helpful in disseminating information to all local welfare committees in need of advice or assistance.

Thus the central committee can provide comprehensive plans for any desired type or size of recreation ground, criticize or design buildings for any purpose, recommend suitable contractors, check or write specifications, obtain special discounts on purchase of nearly every kind of furniture or equipment, and give detailed information regarding the numerous forms of activity in the reference guide that has been issued. This service is paid from the general fund.

Welfare organizers have been appointed also by many of the districts. Some of the smaller districts have combined to engage such organizers, and they have been found essential for preventing waste and developing enthusiasm.

In general, the fund is not used for maintenance but only for construction; however, some sections which have been hard hit by the depression and seem likely to become more active later have been assisted with their maintenance problems. In some instances, mines have closed down, but the men, by traveling to other mines, have been enabled to make a living without change of domicile. In cases where a certificate was furnished by the district committee to the effect that to the best of their belief the project seemed destined within twelve months to be self-supporting, recommendations for grants of maintenance expense have been accepted and needed funds supplied, even though the colliery that formerly supported the men was abandoned or closed.

Some Non-Capital Uses

As the repeated reenactment of the legislation seemed to promise that the fund could be regarded as a permanent provision, more money has been spent for other than capital purposes, such as education or to provide medical treatment. All established developments are, as far as possible, put under the joint management of owners and workers, though apparently in some places it is difficult to find representatives of operators to serve on a committee of administration.

In some districts, work is done only as funds are available; in others, the companies advance money so that the work can be immediately completed; in a third group, the work is planned for the period of duration of the operation of the act and is completed as funds become available. The practice of passing the law for only a restricted period has been unfortunate, as it has caused districts to limit their projects so that all their allotments would be consumed within the life of each enactment. However, as the period has now been lengthened, more adequate planning is possible.

Unfortunately, mines are being closed down and schemes are failing for that reason, with a waste of money such as is universally suffered where changes in activity occur, but, as the degree of impermanence of mining operations is less in Great Britain than here, this has not been so serious a loss.

In some cases, particular localities have held that they had a prescriptive right to a definite proportion of the district fund, based either on the taxes paid by the local collieries or on the number of miners to be accommodated. This claim of right has not been recognized by the central committee. It is likely that in the end the smaller communities will be found to receive a share somewhat larger than thus would be provided, because not only is equivalent service to such smaller community more expensive per capita but also because small communities are more isolated and therefore less adequately served by existent facilities. In the towns, parks and playgrounds are already laid out; libraries, hospitals, convalescent homes and a dozen other facilities are available which do not need to be duplicated. Even with a much greater expenditure per head, the cost of providing for such communities will make it necessary to be somewhat more niggardly in providing facilities than the committee would desire.

Grants for recreation up to Dec. 31, 1934, were $24,153,213; for pit welfare, $16,811,144; for health, $15,797,895; for education, $5,674,908; for research, $4,120,183; miscellaneous purposes, $262,611; and for administration, $1,028,369, making total grants $67,848,324 and balance unallocated of $2,767,170.

South Wales had up to Dec. 31, 1934, no less than 335 projects; County Durham, 291; South Yorkshire, 214; Lanarkshire, 181; Fife and Clackmannan, 159; Derbyshire, 153; North Wales, 128; Northumberland, 126; Warwickshire, 107; West Yorkshire, 104; Nottinghamshire, 75; Forest of Dean, 52; Lothians, 49; South Derbyshire, 47; North Staffordshire, 41; Leicestershire, 40; Somersetshire, 38; Cannock Chase, 33; Cumberland, 28; South Staffordshire, 18; Kent, 16; Shropshire, 14; Ayrshire, 8; Lancashire and Cheshire, 8; Bristol, 7; a total of 2,272 projects.

Projects Large and Small

In no way does this express the sums of money expended in the several districts, for the expenditure depends largely on the size and importance of the projects chosen as well as on their number. In fact, some of the most important mining areas have fewer projects than the less important, because apparently the more important districts have concentrated on the larger projects. However, South Wales has the largest expenditure and also the greatest number of projects.

From the first the committee has been well served, first by Viscount Chelmsford, then by Lord Noel-Buxton and later by Major-General Sir Frederick Sykes. The first occupied the chair until 1921 and was a moving spirit in developing the policies of the fund. The two operators' representatives in the central committee have been appointed after consultation with the Mining Association of Great Britain and those representing the mine workers with the advice of the Mineworkers Federation of Great Britain.

NOTES
From Across the Sea

GREAT BRITAIN is still wrestling with the study of rank in coal and, most unfortunately but quite naturally, frequently bases its judgment on a pressing consciousness of its own experience, which is greatly differentiated from that of the United States. A few individuals seem to have an international viewpoint and are able to cull from the United States and elsewhere facts which show that British coincidences are in certain cases purely accidental and, therefore, not a true basis for generalization. However, theories based on local conditions frequently serve a useful purpose, because those who seek to maintain them often uncover many facts that otherwise might be overlooked and which have value in arriving at a complete picture of the existing conditions.

Hilt's law, for instance, doubtless has a larger place in Britannic studies than American experience would accord it. Had it not been for a wonderful exemplification on the Continent of Europe it might not have been stated as a law for generations, but its meaning for America may grow as deeper beds are operated. In the anthracite region perhaps conditions are not favorable for an exemplification of Hilt's law, because the coal has reached such a high degree of carbonization that a few degrees of temperature makes little difference in its rank. Perhaps, moreover, the temperature gradient in the north of Germany and France and in the Low Countries at coalification periods was greater than it has been in like periods in the United States or in parts of this country.

At the meeting of the British Association for the Advancement of Science, H. G. A. Hickling, in his presidential address to the geological section, discussed the increase of rank as formulated by Hilt and made the statement that the condition of the coal was an indication of the pressures and temperatures to which it had been subjected, but, he said significantly, it was a thermometer that recorded maximum temperature only, because it is extremely unlikely that a coal ever loses rank once that rank is attained.

But, if Professor Hickling would discuss these temperatures and pressures, he must consider all pressures, whether from depth or mountain-making stresses as sources of increased temperatures. In a single drill-hole or shaft the variation of temperature due to depth may be the controlling factor, for the lateral pressures at all depths are likely to have been quite similar, but between one sector of the earth's surface and another at a different distance from the center of disturbance, or in the presence of faults and folding (points where pressure was eased by retreat), the differences in these original pressures and temperatures usually would be far more important and more determinant of coal rank than temperature gradient. Thus Hilt's law can be used as a determinant of the temperatures at which rank changes took place only where there is no evidence of side pressure and where the depth of maximum cover and the temperature gradient are known.

But here it should be injected that pressures do not in themselves create heat but only as they create or retard atomic, molecular, granular or more general movement. It is when force is imposed that it generates heat, though the effect may linger long after that imposition. Hence, the slow burying of deposits raises temperature mainly by preventing them from passing heat to the surface and not by the load they impose on the deposits. Force is not energy and therefore is not heat.

It must be remembered always that depth not only increases temperature but that its accompanying pressures have an important effect on chemical action. One cannot Berginize coal with temperature alone; pressure also is needed; and rubber can be melted at a high pressure at a lower temperature than suffices at a low pressure. These are but two illustrations of a chemical fact that has many applications.

Professor Hickling opposes the view that the character of coal-peat varies progressively from the margin of the deposit to its center. As he says, the isovols, or the many similarly contrived patterns, do not suggest it. If it be true that depositional position has an effect on rank, the effect must be small indeed, for the isovols never parallel the edges of the deposit but cross it at a definite angle. The United States is a good place for such study because the mountain-making movements are far more simple than those of Great Britain. Isovols do not repeat themselves on the opposing sides of a deposit but lie closest at the stressed end of the bed, become less frequent as they travel from it and, if the deposit is large enough, may be entirely absent at the far end of the bed where a uniformity of volatility makes it impossible for any more isovols to be drawn.

Time as a factor in creating rank is dismissed by Professor Hickling. "The oft-quoted fact," he says, "that Tertiary coals are mostly of low rank (lignites) and the Carboniferous ones mostly of high rank (bituminous or anthracite) may be dismissed with the comment that it is a fairly obvious agreement with the fact that the former are for the most part contained in relatively thin deposits and the latter in much thicker accumulations, while the formation of Tertiary anthracites under appropriate conditions sufficiently disposes of any suggestion that the mere lapse of time is a necessary factor."

However, if the first part of the sentence refers to the total cover, the thickness of the coal-bearing strata, or even to the thickness of the coal beds themselves, the State of Washington would furnish evidence to the contrary. The Tertiaries in the United States seem to have been as heavily covered, to have had as thick or thicker rock intervals and to have thicker beds than the Carboniferous measures of the East, though, due to possible erosion, the matter of cover is not so well established. But where the cover has been thick, the coal is of bituminous rank. Time does seem to have some effect in raising rank, even though Tertiary anthracites are found in some places. Because under certain conditions such anthracites are formed is no evidence that time has no carbonizing effect. Evidences as to this effect are difficult to obtain, and a verdict of "not proved" is all that can be obtained. In justice to Professor Hickling it should be admitted that coalification probably is so much quickened by pressure (apart from heat) that time is a relatively unimportant factor except in the preliminary peat periods, when the activity of bacteria makes the change rapid.

ENGLAND is hoping to dig up a new coal field; this time in southeast Essex on the northern side of the Thames estuary. Under the London clay (but not under London) under the London Tertiaries, the thick chalk and the Gault (another clay bed) a sector of Carboniferous coal measures appears to be hidden, almost abutting on the Kent coal field—now well developed—that made such a stir when it was discovered. This putative section perhaps extends under the mouth of the Thames. Whether it exists and whether it contains workable seams remain to be determined, but H. A. Baker, who has been a government geologist both in the Dominion and Colonial governments, from his studies of boreholes in Kent and Essex—the latter of which do not penetrate the coal measures—and from his maps believes that it does, and sets forth that belief at length in the *Iron and Coal Trades Review*. At a depth of about 1,500 ft. the coal measures should be reached, but, as they are 2,000 ft. thick, the shaft may have to be sunk some distance to reach workable seams. The chalk is a rather difficult measure, with connected solution cavities carrying large quantities of water. If the shaft does not miss them, or municipal needs have not drained them, it will give plenty of trouble, because the field is in the basin of the Tertiary measures, and water will drain in from all sides. But as to these difficulties Dr. Baker says nothing. Doubtless they can and will be met. Meantime, as the author of the article names it, it is "an undiscovered coal field."

PROF. W. A. BONE and his coworkers of the Imperial College of Science and Technology, London, in an address before the Royal Society, attack the notions of the school which declares that, from the cellulose in vegetal matter, we derive the lignin and bituminous matter in coal. In his conclusion he agrees with Professor Fischer in Germany and the Thiessens in the United States, who hold that the decomposition of cellulose in the early years of peat formation removed all that material from the bog, the coal being derived from the lignin remaining. Opposing these authorities, E. Berl, Carnegie Institute of Technology, Pittsburgh, Pa., is the outstanding representative in this country of the cellulose-to-coal theory. D. T. Jones and R. V. Wheeler, of Eng-

land, believe that the coaly matter is derived not only from lignin but from cellulose also.

One of the reasons which Professor Bone advances for believing that lignin is the source of coal, and not cellulose, is the high ratio of carbon to hydrogen in the lignins from wood and in the coaly substance of even the earliest of lignites as well as in the more developed coals. The carbon-to-hydrogen ratio for silver fir is 11.0, and for bagasse, the waste material of sugar cane after the sugar has been extracted, it is 8.8. For coal, as is well known, the ratio of carbon to hydrogen is even greater, but for cellulose, which some declare to be the parent of coal, the ratio is only 7.2, cellulose being $C_6H_{10}O_5$ and hydrogen being one-twelfth as heavy atomically as carbon.

Only lignin, declares Professor Bone, possesses the carbon-ring, or aromatic structure requisite for the production, in coal, of the benzenoid nature that his researches determine to be the outstanding characteristic of coal of all ranks, including anthracite.

R. Dawson Hall

On the ENGINEER'S BOOK SHELF

Orders for all books and pamphlets reviewed in this department should be addressed to the individual publishers, as shown, whose name and address in each case is in the review notice.

America's Capacity to Consume, by Maurice Leven, Harold G. Moulton and Clark Warburton. Brookings Institution, Washington, D. C. 272 pp., 5¼x8½ in. Price, $3.

In this volume is an exceedingly detailed study of the national income, whence it is derived and how it is spent, and then follow several conclusions which in the main probably are sound. Among conclusions reached are that during the so-called era of the gay twenties the United States was not living beyond its means . . . The facts show that we actually produced more in 1929, for example, than was consumed. The authors add that "we might readily have produced, with the existing resources, plant and equipment, and labor supply and without improvement in methods, approximately 20 per cent more than we did produce." But this must be held to be an incidental remark, for our means are what we make them, not what we could have made them.

Other conclusions are that "there has been a tendency, at least during the last decade or so, for inequality in the distribution of income to become accentuated" and that "vast potential demands alike for basic commodities and for conventional necessities exist in the unfulfilled wants of the masses of the people, both rural and urban, for at each successive income level the expenditures of families and of unattached individuals do increase for food, shelter and clothing as well as for the comforts and conveniences of life. One may conclude, therefore, that if by some means the income of those in each income group could be lifted to the next higher group, their expenditures would be increased in line with the expenditures of those who were theretofore in such income groups."

Another conclusion is that "the United States has not reached a stage of economic development in which it is possible to produce more than the American people as a whole would like to consume;" that "we cannot materially shorten the working day and still produce the quantity of goods and services which the American people aspire to consume," and that "in emphasizing the need of increasing consumption we must not forget the necessity of simultaneously expanding production."

It might be commented, however, that if a group is raised in purchasing power it may retain some of its frugal habits and not consume as much as the group in which its increased income places it; on the other hand, it may be disposed to live up to its means, as it did when its means were less, and thus outspend the group into which it enters. There are individual units which will come under both categories. Perhaps the authors' surmise is, therefore, not far from the truth.—R. DAWSON HALL.

The Determination and Control of Industrial Dust, by J. J. Bloomfield and J. M. Dalla Valle. Public Health Service, Washington, D. C. Bulletin 217; 168 pp., 5¾x9⅛ in. Price, 15c.

This book deals not with the sanitary conditions of the several dusty industries but with surveys to evaluate the importance of the dust problem for each class of worker in any industry, with instruments and methods used to collect the dust for counting, somewhat incorrectly termed "dust-sampling instruments," with means of determination of the quantity of dust per cubic foot of air, with the methods of determining the character and composition of dusts, with the application of dust determination to the dust hazard and clinical studies, with dust-control methods, design of hoods and local exhaust systems, with exhaust ventilation, dust collection and disposal, with measurements of air flow and with personal respiratory equipment. Bituminous rock-drill dust is declared to have 54 per cent of quartz; anthracite rock-drill dust, 31 per cent; but anthracite has 1.5 per cent of quartz; and bituminous coal, 1.2 per cent. However, it would seem that these figures depend greatly on the point where the dust was collected. The authors appear to accept the theory that free silica is the principal offender among siliceous dusts.

Les Cuvelages, Theories et Applications, by Lucien Denoël. Dunod, Paris. 209 pp., 4⅞x7¼ in.; paper.

This publication, though it has a French publisher, is written by the Chief Inspector of Mines of Belgium, who also is professor of mine operation at the University of Liége. Though in general it deals with the design of linings of shafts, it also discusses at some length sinking through running measures by the aid of refrigeration. As the shafts in Europe are in general circular or elliptical, such shafts are given exclusive treatment. Subjects treated are the theory of simple linings, its application to the pressures imposed on the lining by movable, water-bearing rocks; coefficients of safety and limit of depth; masonry, concrete, reinforced concrete, cast-iron, cast-steel and compound linings; some specific instances of lined shafts and the method of sinking by freezing methods.

Report of H. M. Electrical Inspector of Mines for the Year 1934. British Library of Information, New York, N. Y. 109 pp., 6x9½ in.; paper. Price, 62c.

This report summarizes the coal-mine accidents during the year 1934 and gives a detailed report on each fatal accident. Metalliferous mines and quarries, which follow, had no fatalities and only three nonfatal accidents. A list also is given of all the certificates for flameproof inclosures in electrical apparatus during 1934.

Of the installed horsepower of motors in British mines, 82.8 per cent is of alternating current. In the Northern inspection division, 94.4 per cent is of that type. All accidents due to ignition of firedamp or fire below ground arising from electrical maladjustments are charged to electricity in the tables contained in this report. While these two causes resulted in only 20 fatal accidents, as against 82 for electric shock, they accounted for no less than 94 fatalities, as contrasted with 84 for electric shock, for many of the ignition accidents involved a large number of men. In the 840 mines using coal-cutting machines, 4,451 were electric and 2,955 were driven by compressed air. Of all machine-cut coal, 71.2 per cent was cut by electricity. Of all coal mined, 45.9 per cent was machine cut.

The Resistance of Mine Timbers to the Flow of Air as Determined by Models, by Cloyde M. Smith. Engineering Experiment Station, University of Illinois, Urbana, Ill. Bulletin 279; 62 pp., 6x9 in.; paper. Price, 65c.

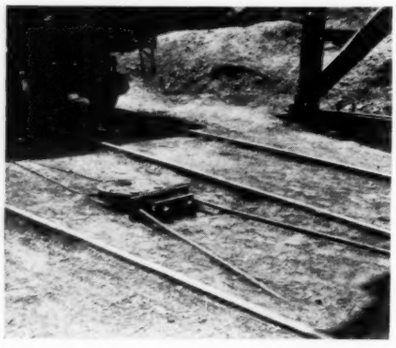
This study extends an earlier one made by Pen-Chun Hsu at the same university and hitherto not published. It corroborates that investigator's conclusion that for every shape and size of timbering there is spacing which results in a maximum resistance for the length timbered, and that there is a close spacing which yields a minimum zonal resistance; this, apparently, because the air where the spacing is close does not have an opportunity to expand to the full cross-section between timbers and thus does not experience the full turbulence. If the distance between timbers is sufficient that the air has opportunity to resume axial flow, however, the resistance caused by the presence of timbers is decreased.

OPERATING IDEAS

From Production, Electrical and Mechanical Men

Layer-Loading Hoist Mounted On Long Crossties

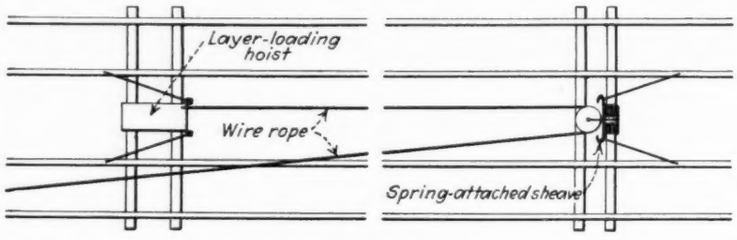
Supports consisting of long crossties and anchorages to the rails feature the layer-loading hoist installations at the Stotesbury (W. Va.) mine of the Koppers Coal & Transportation Co. The method is far less expensive than the conventional concrete foundation and anchorage and lends itself to changes that experience may indicate are desirable.



The sheave is anchored at a point several car lengths upgrade from the tipple

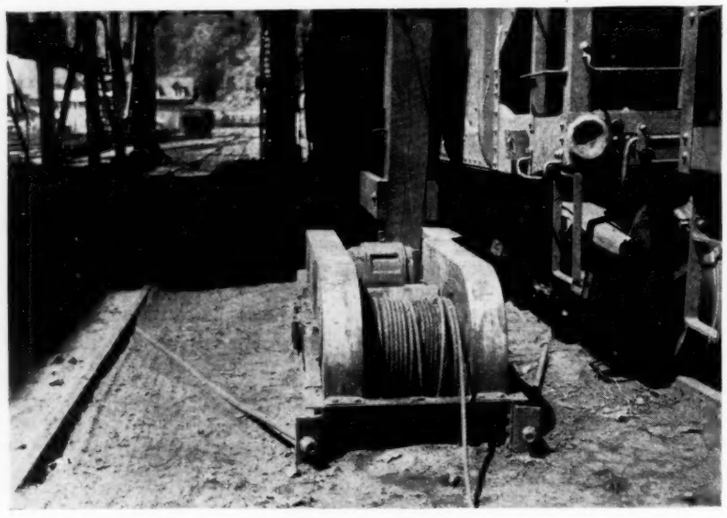
Layer loading, as practiced by the Koppers company, which was described at the Cincinnati convention by A. F. Castanoli, preparation engineer (*Coal Age*, June, 1935, p. 251), entails the handling of one railroad car or perhaps a string of two to six cars so that they can be passed downgrade under the loading boom a number of times to receive their loads in layers, thus avoiding segregation, concentration of some particular grade or other variation in the coal in one car or in one part of a single car.

To handle the cars at Stotesbury, a combination single-drum hoist and car retarder furnished by the Brown-Fayro Co. is employed. This machine is powered by a 15-hp. motor, the drive is positive, an automatic brake is included, and a "free-wheeling" unit is incorporated. Wire rope ¾ in. in diameter is used and the maximum load is three railroad cars.



Anchor rods of the hoist take the pull

The accompanying drawing and halftones illustrate how the hoist and spring-attached sheave are mounted on long ties and anchored to the nearest rails by 1¼-in. tierods. This method has proved to be entirely satisfactory over a period of about one year.

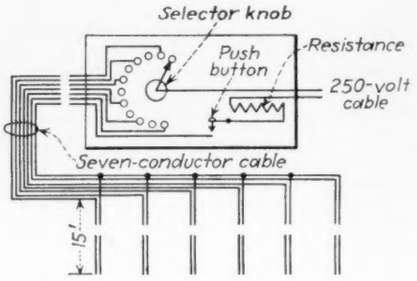


Hoist and sheave installed between adjacent loading tracks

Firing Rheostat Reduces Cost For Gang Crew Shooting

Conveyor-mining shooting cost per ton of coal was reduced approximately 3c. at the Affinity (W. Va.) mine of the Pemberton Coal & Coke Co. by use of a shooting rheostat which provides rapid-sequence shooting with plain detonators. When conveyor mining was installed in March, 1935, working 40-ft. rooms (p. 91, this issue), delay detonators were employed to fire in rapid succession the six shots per face. The high cost of these detonators compared to the plain type prompted the change.

As indicated by the illustrations, the shooting rheostat consists of a small box containing a resistor, pushbutton and a selector switch. The latter has six active buttons spaced by "dead" buttons. A two-



Power- and firing-cable connections are permanently made inside the firing rheostat

Rheostat lying on the bottom against a prop

conductor 250-volt feeder cable and a seven-conductor firing cable are permanently connected into the box. A pair of single-conductor wires 15 ft. long are brought out of the shooting cable at points spaced to equal the shothole spacing along the face. Dead buttons between the active buttons prevent the selector contact point from touching two live buttons at once, which condition would make it possible to fire two shots simultaneously. Use of 15-ft. leads keeps the main firing cable back far enough from the face so that it is not damaged by falling or rolling coal.

After the six holes are loaded and connected to the seven-conductor shooting cable and the 250-volt connection to the mine power circuit is completed, the shotfireman stationed at the shooting rheostat, which has been placed in a safe position, turns the selector knob to a point corresponding to the location of the first shot to be fired and pushes the button. He shoots the remaining five shots as fast as he can reset the knob and push the button. Points of the selector switch are identified by numbers from 1 to 6 stamped on the case. Near the pushbutton, the same numbers, arranged in proper firing order, are stamped.

Delay detonators cost approximately 20c. each and six of them were used for each 25 tons of coal produced. Thus with a four-room conveyor unit working two shifts the detonator cost was $19.20 per day. The plain detonators now used cost approximately 6c. each and their daily cost per conveyor unit is $5.76.

The shooting rheostat shown in the halftone is made of fiber and the outside dimensions are approximately 6 in. wide, 18 in. long and 5 in. deep. William Thompson, chief electrician, who made up the first rheostats in the mine shop, contemplates a new design of lighter weight and smaller dimensions, using an insulating material which will not warp due to moisture, as is the tendency with plain fiber.

★

Head and Feet

THOSE MEN who find that elevation of the feet to the top of the desk is an aid to thinking now have the indorsement of an authority on mental processes. But if those men are engaged in the mining of coal, they also are obliged to supplement this comfortable consideration of matters with thinking on their feet —a somewhat more difficult task, calling for not only mental agility but a knowledge of general principles as applied to specific problems. The retailing of examples of such application of general principles to specific problems is a function of this department. It draws its material from the experience of operating, mechanical, electrical and safety men, and solicits your solution of a problem which you may have encountered. So send it in with a sketch or photograph if either will help to make the idea clearer. Acceptable ideas are paid for at the rate of $5 or more each.

★ ★

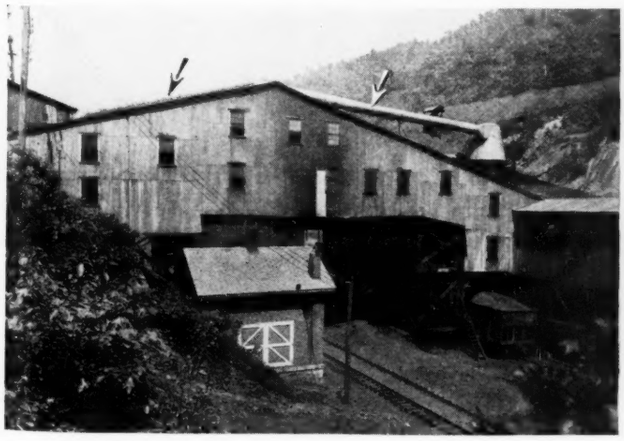
Dust From Dump at Slope Bottom Removed By Vacuum Fan at Tipple

ALLAYING dust at an underground dump or transfer point by wetting the coal with sprays is more or less objectionable in most cases and is impractical at many mines dumping underground to skips or conveyors. Dry dust collection by air exhaust involves the problem of handling and disposing of the collected dust, but a practical solution of that problem is indicated by the recent installation of a blower, slope duct to the outside, and a cyclone collector unit at the Stotesbury (W. Va.) mine of the Koppers Coal & Transportation Co.

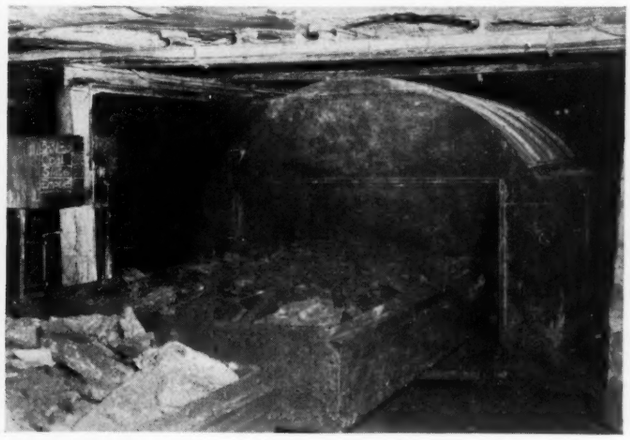
Coal from the lower seam is carried up a slope from the underground rotary dump to the tipple by a belt conveyor 42 in. wide and 400 ft. long. Formerly considerable dust escaped at the dump and lesser quantities were loosed to the atmosphere at the other two underground transfer points: viz., dump hopper to apron feeder and apron feeder to belt conveyor. To effect complete control of the dust, the dump and the other two transfer points were inclosed and each was connected to the suction duct of a 37x15-in. Robinson blower installed in the tipple.

The main vacuum duct, which is hung from the top in the slope alongside the belt conveyor, is a round pipe 30 in. in diameter made of galvanized No. 20 gage steel reinforced with split belts or collars of 1-in. angle iron mounted on the outside. The pressure duct, approximately 100 ft. long, connecting the blower to a Young & Bertke cyclone collector, is the same in size and construction except that the steel belts are omitted.

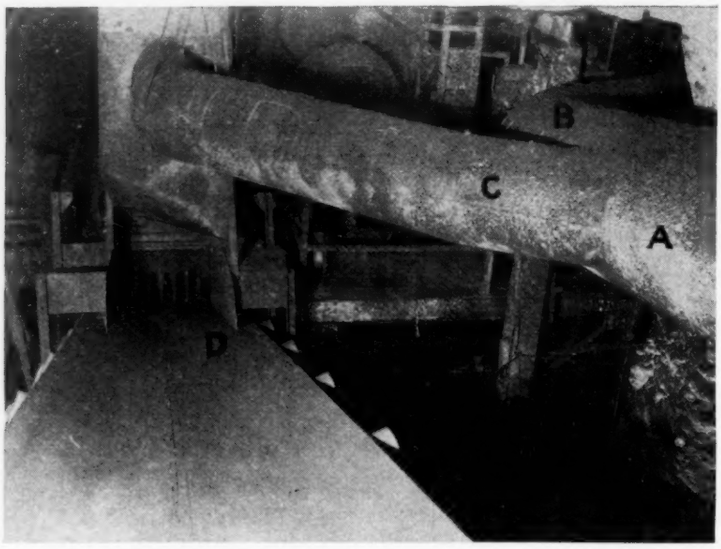
Continuous load imposed by the equipment is close to full rating of the 15-hp. 850-r.p.m. motor which drives the blower.



From a blower inside of the tipple and close to the slope opening a pipe carries the dust overhead to a cyclone collector



Car entering under a curtain and into the dump inclosure. (Slate instead of coal was being dumped when the photo was made.)

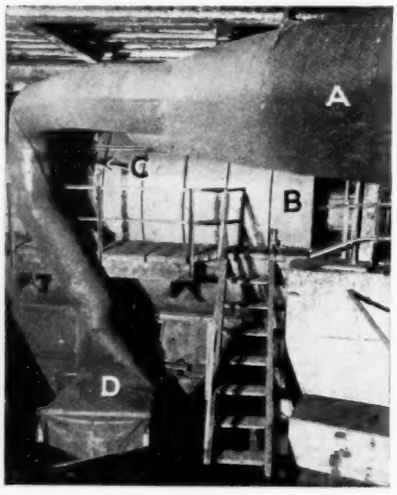


"A" is the 30-in. duct leading up the slope; "B" is the branch duct to the dump; "C," the branch duct to the inclosure at top of feeder; and "D," the slope belt

Normal capacity of the cyclone collector is 15,000 cu.ft. of air per minute.

Coal dust collected by the cyclone unit, which amounts to approximately 125 lb. per day when dumping 1,000 tons of coal, is loaded with the slack. Men working at the slope bottom are relieved from the disagreeably dusty condition which formerly existed and, of greater importance, a safer condition exists than was possible when accumulations of dust were removed by hand and dilution with rock dust was a more difficult problem.

A small window in the side of the dump inclosure and a lighting unit afford the dumper a view of this operation. Brattice curtains at the ends of the dump and at the coal travel openings of the feeder and belt inclosures aid in confining the dust and limiting the total area of openings through which air can enter.



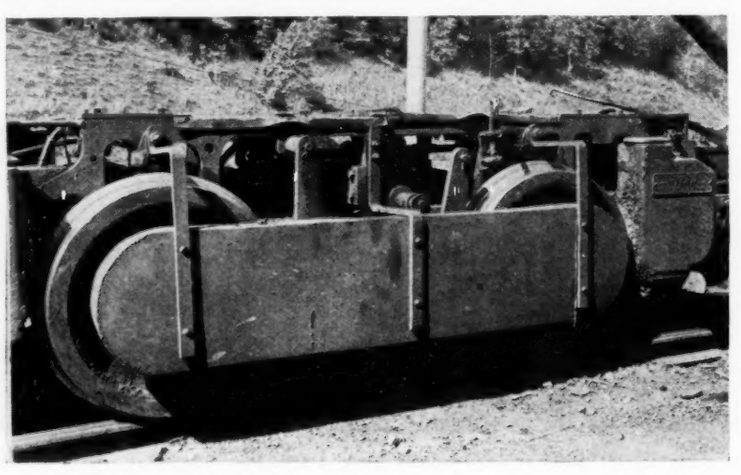
"A" is the branch duct to the dump; "B," the dump inclosure; "C," one end of the operator's window; and "D," the inclosure and curtain at the lower end of the feeder

Four-Wheel Drive Attained By Outside Chain

Only in the last few years has the coal industry begun to recognize generally the practical operating advantage of having the two axles of a mine locomotive geared or "chained" together so that with operation of the motors in series one set of wheels cannot slip and thus reduce the torque supplied by the other set. Operators of single-motor locomotives have recognized the advantage, but it took the general trend toward slow-speed gathering locomotives to focus attention on the advantage of four-wheel drive. Connecting the motors permanently in series to lower the speed required that the two axles be operated as a unit, and it is that "slow-speed" move which has spread the chained-axle practice to "regular-speed" locomotives.

At certain mines, axle chains are now being added to locomotives on which the series-and-parallel control is not disturbed. And that this is true, even on inside-frame locomotives, which afford no inside space for the additional equipment, is indicated by the accompanying illustration from a photograph made at the new mine of the H. E. Harman Coal Corporation, Harman, Va.

The illustration shows a chain added to the outside of an inside-frame 6-ton locomotive having No. 904 motors. The change was accomplished by fitting the locomotive with new axles of sufficient additional length to allow mounting the chain sprockets outside of the wheels. The chain with its guard increases the locomotive width by 4 in.



An inside frame and lack of space did not bar conversion to positive drive

Gear Pullers

Two pullers for difficult gear-removing jobs on Joy 5BU loaders are offered by Walter Baum, master mechanic, Perry Coal Co., O'Fallon, Ill. The first of these pullers (Figs. 1 and 3) is used to remove the splined spur gear on the armature shaft. When new, this gear has a push fit, and after a few years' use it was found that the gear had locked tightly on the shaft due to dust and grease packing in the splines. Space between the gear and the grease retainer is about $\frac{1}{16}$ in., which is not sufficient for a hold on the back side of the gear. The puller described, Mr.

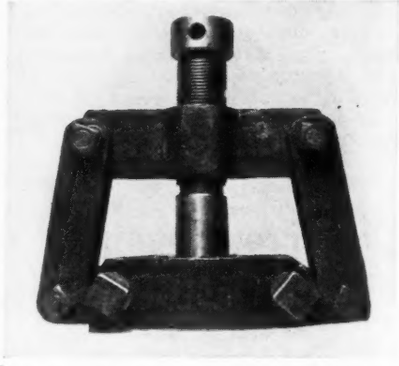


Fig. 1—Spur-gear puller assembled

Baum reports, successfully removed the gear.

To make the puller, Parts 1 and 3 (Fig. 3) are cut out of a 2½x2½-in. piece of mild steel with a cutting torch. The outside of these parts requires no further finishing, and the inside is left about ¼ in. smaller than the final dimensions. Parts 1 and 2 are then clamped together and $\frac{3}{16}$-in. pilot holes are drilled through both ends as guides for the $1\frac{1}{32}$-in. holes in Part 2 and the $\frac{25}{32}$-in. holes in Part 1.

Parts 5 and 6 are cut out of 1x2-in. mild steel, previously drilled with two $1\frac{1}{32}$-in. holes. After cutting, the parts

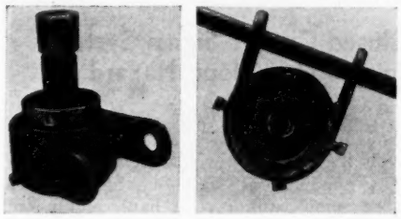


Fig. 2—Two views of bevel-gear puller

are fastened together with a 1-in. bolt and the $\frac{5}{8}$-in. hole is drilled through both pieces at once. Part No. 1 is then tapped with 1-in. U.S.S. threads, and two bolts, No. 4, are made and threaded. Parts 1 and 2 and 5 and 6 are then laid on a flat surface with a ⅛-in. washer between 1 and 5 and 5 and 6. Bolts No. 4 are then drawn tight, and the assembly is placed in the lathe chuck and bored out to fit the gear pulled. Enough metal should be left on Parts 5 and 6 to allow turning, after which the ⅛-in. washers, having fulfilled their purpose of providing space for the free movement of 5 and 6 after 1 and 2 are clamped on the gear, are discarded.

The pulling screw, with thread and center protector, is made as in Fig. 3. Top Part No. 3 is placed in the lathe chuck and the center is drilled and bored out, leaving material for a thread to accommodate the pulling screw. Drilling two $\frac{5}{8}$-in. holes completes operations on Part No. 3. Four straps (Fig. 3) are made, and the puller can then be assembled with four $\frac{5}{8}$x2½-in. machine bolts.

The second puller developed by Mr. Baum is designed to remove the No. 1528 bevel gear from the shaft in the gear case. The shaft and gear are subjected to severe strains, with the result that the key sometimes shears lengthwise, locking the gear to the shaft. In removing one gear, a 5½-ft. length of 1½-in. pipe was necessary to secure the proper leverage, the pipe slipping on one end of a piece of heat-treated steel shaped on the other end to fit the holes on the puller screw.

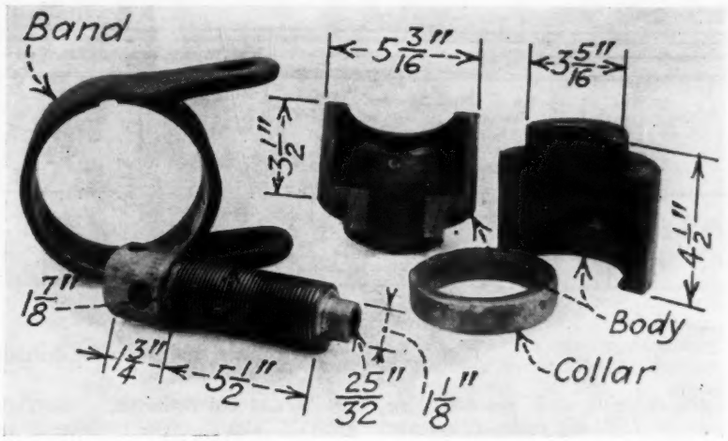


Fig. 4—Details of No. 1528 bevel-gear puller

To make the puller, a piece of 6-in. shafting 7 in. long was employed. The piece was chucked in the lathe chuck and a center drilled in the opposite end, after which the outside was turned down to form the body (Fig. 4). The steady rest was then put on the lathe to support the end, after which the inside was bored out and the thread cut in the rear end, using the pulling screw previously made as a gage. Thereafter the body was cut off to the proper length with a cutting tool. The collar was then made to fit snugly around the shoulder on the thread end of the body. Next, the band was fabricated, the two ears, previously drilled with 1¼-in. holes, being welded on, after which the band was machined to fit the body of the puller. After this operation, the body can be sawed into two halves. Two notches are cut in the band, which is fitted on the body to allow it to be marked for the two $\frac{13}{32}$-in. holes in which two studs, serving as lugs, are screwed. The holes for the studs are tapped out with a ½-in. standard tap. The band is equipped with ears and lugs so that the puller can be kept from turning when pressure is applied to the pulling screw.

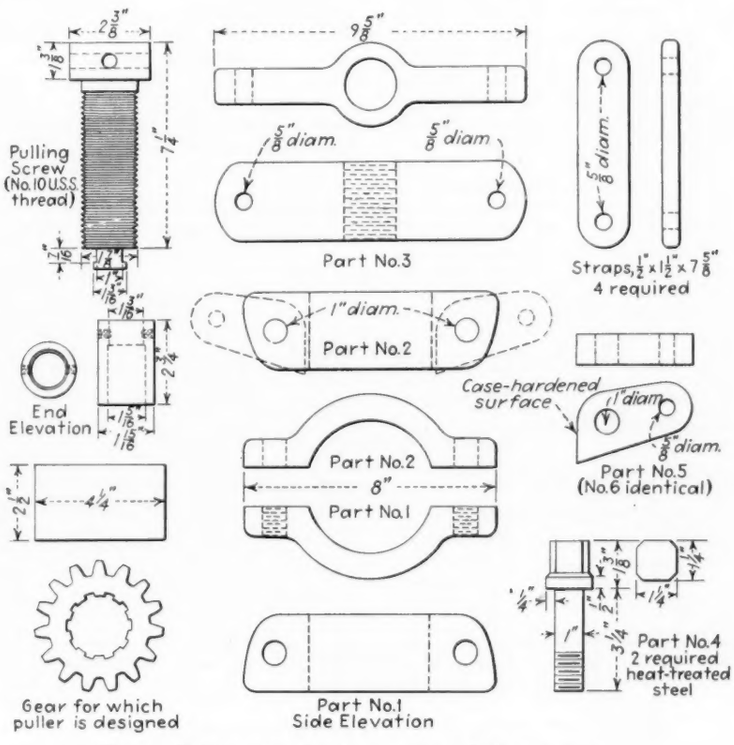
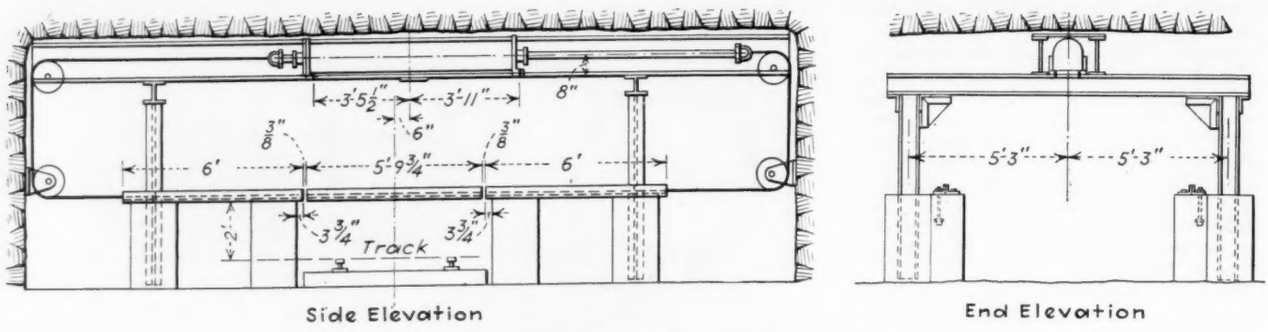


Fig. 3—Details of puller for armature-shaft spur gear

Air Cylinder Shifts Battery Of 8-Ton Locomotive

Compressed air being available inside of the mine, it was selected as the power for shifting battery boxes in a charging station at Lansford colliery of the Lehigh Navigation Coal Co. The locomotive accommodated is a General Electric 8-ton permissible equipped with two 42-cell 29-plate Exide-Ironclad batteries fitting it for double-shift duty.

Battery-box crossrails on top of the locomotive chassis are 5 ft. 9¾ in. long and the

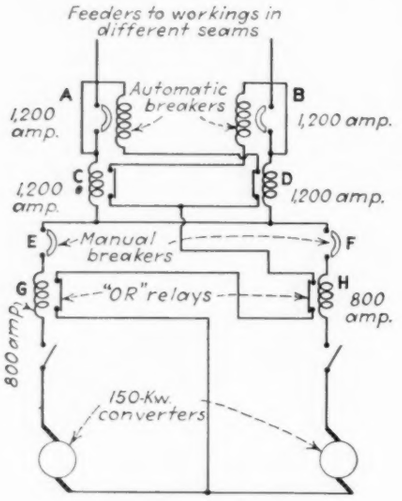


Air cylinder and tracks for shifting permissible batteries

rails of the charging stalls are 6 ft. long. One 10-in. x 7 ft. air cylinder mounted crosswise on structural steel above the center of the stalls shifts the batteries through the medium of wire ropes and pulleys. The battery to be removed from the locomotive is hooked to the one to be applied and both are moved sidewise together.

Relays Reduce Trip Stoppages On Heavy Grades

To interrupt temporarily a circuit overloaded by or coincident with a locomotive pulling a heavy trip on a grade introduces the disadvantage of having to start the trip on the grade, thus creating for that locomotive a demand greater than when it was pulling its trip. At the Chattaroy (W. Va.) mines of the fuel department of the Norfolk & Western Railway Co., where a two-unit substation feeds workings in two seams, the substation has been equipped with additional relays which upon overload open the breaker of the circuit to the seam in which the load is the lightest, thus allowing the peak of the other circuit to terminate naturally without interruption.



Both load limiting and protection are automatic

Referring to the diagram, the two feeder circuits had been equipped for several years with the Columbus automatic reclosing breakers *A* and *B*, including the Type OR relays *C* and *D*. The revision of circuits to secure the new arrangement included installation of two additional OR relays, *G* and *H*.

If the combined load on the two outgoing feeders exceeds the capacity of either converter operating singly or of both converters operating in parallel, one or both relays *G* and *H* will operate to open both of the reclosing breakers *A* and *B*.

Breakers *A* and *B* are cross-connected so that a heavy load through one causes opening of the other. In case the heavy load is a short-circuit instead of a normal haulage peak, then the relays *G* and *H* will open the automatic breaker of the short-circuited feeder. Manual breakers *E* and *F* are adjusted to a high setting and function only when one of the converters is shut down or in case the speed-limiting device operates.

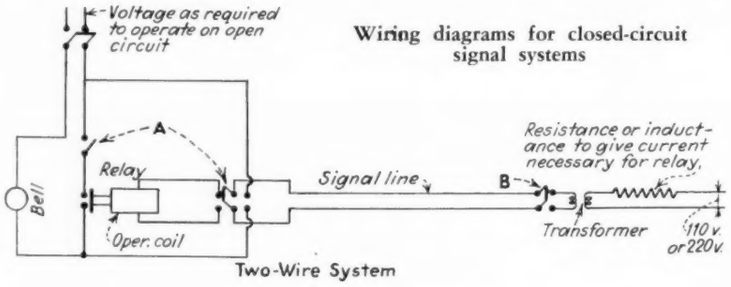
The relay arrangement acts in a measure as a load limiter and therefore can be credited with a certain saving in purchased-power demand charges. Also, this limiting action of the breakers has made it possible to continue operation with increased load without installing a third substation unit. C. R. Binford, of the West Virginia Engineering Co., designed the arrangement, and T. V. Maynard, chief electrician for the coal company, made the installation.

Closed-Circuit Signal System Avoids One Slope Hazard

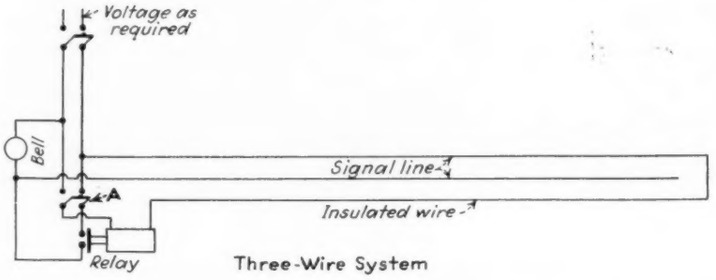
A signal system using a closed circuit instead of the common open circuit would avoid the danger of broken signal wires and thus eliminate at least one hazard in a slope mine with a rope haul, points out E. P. Jaggard, chief engineer, C. A. Hughes & Co., Cresson, Pa. A rock fall that would break a wire, Mr. Jaggard observes, would wreck a trip. In the closed-circuit signal system shown in the accompanying illustration, a signal would be given by shorting the wires at any point or by breaking either wire.

The relay shown normally closes the bell circuit and is held open by the current in the signal wire. Two separate sources of power are required: one inside and one at the hoist. The signal line voltage should just be sufficient to give the current required to operate the relays and will depend on the length of the line. A resistance or inductance must be inserted in the primary circuit to limit the current flowing when the signal wires are shorted. Switches *A* and *B* are to permit the use of an open circuit, if desired. If alternating current is not available inside the mine the same general scheme may be applied, but with three wires instead of two.

Wiring diagrams for closed-circuit signal systems



Two-Wire System



Three-Wire System

WORD FROM THE FIELD

Mining Congress Shaping Plans For Cincinnati Meeting

Plans for the annual convention and exposition to be held under the auspices of the coal division of the American Mining Congress at Cincinnati, Ohio, May 11-15, are shaping up rapidly under the direction of R. E. Salvati, national chairman of the program committee and general manager of the Island Creek Coal Co. The first tentative program for the eight technical sessions of the convention was issued a few days ago and covers a wide range of topics of interest to practical operating men. Among the subjects listed are:

Coal Production Methods—Today and Tomorrow.
Progress of Mechanical Loading in Various Fields.
New Things in Mine Safety.
Hitch-Drill Practice.
Portable Mine-Car Compressors at Pond Creek Pocahontas Coal Co.
Effect of Width of Places on Top
New Things in Coal Cleaning
Trip Dispatching and Car-Movement Records.
Relation Between Life of Entry and Type of Track Equipment.
Power-Plant Operation.
Driving Rock Tunnels With Shaking Conveyors and Duckbills.
Cutting-Bit Treatment.
Power Efficiencies.
Mercury-Arc Rectifier.
Newest Developments in Strip-Mine Haulage.
Coal Bumps Under Heavy Cover.
Accident Records.
Rock-Dusting.
Increasing Efficiency in Transportation.
Aero-Mechanics as Applied to Mine Ventilation and Fans.
Employees' Safety Meetings.
New Things in Coal Treating.
Coal Distillation.
Cutting Out Slate Bands.
Face Preparatory Methods.
Prospecting for Coal With Diamond Drills.
New Designs in Car Construction.
High Production in Cutting-Machine Efficiencies.
New Devices and Means of Reducing Electrical Maintenance of Equipment.
Mechanical Loading System.
Air Conditioning.
Haulage Practice.
Trackless Mining.
Welded Rail Joints.

District chairmen cooperating with Mr. Salvati in arranging the technical program include C. E. Cowan, vice-president, Monroe Coal Mining Co., Pennsylvania; W. F. Hazen, general superintendent, Wheeling Township Coal Mining Co., Ohio; T. J. Thomas, president, Valier Coal Co., Illinois; Wesley S. Harris, president, Bicknell Coal Co., Indiana; Henry F. Warden, general manager, American Coal Co. of Allegany County, West Virginia; R. E. Galbreath, Wisconsin Steel Co., Kentucky; A. H. Reeder, general superintendent, Stonega Coke & Coal Co., Virginia; L. Russell Kelce, vice-president, Hume-Sinclair Coal Mining Co., Southwest; D. R. Swem, manager of coal operations, Northwestern Improvement Co., Rocky Mountain and Pacific States. Fifty-seven operating officials from all parts of the mining areas are members of the program committee.

Early reports on sales of exhibition space point to a large display of mining equipment at the Cincinnati exposition. All space in the north and south wings of the exposition hall have been sold and arrangements are being made to house additional exhibits on the second floor. Up to Feb. 14 space had been assigned to 102 companies serving the coal-mining industry.

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New Preparation Facilities

HICKORY GROVE COAL MINING CORPORATION, Terre Haute, Ind.: contract closed with Jeffrey Mfg. Co. for strip-mine preparation plant designed for loading on five tracks 100 different sizes in 35 combinations. Equipment will include a Jeffrey automatic Baum-type three-compartment jig with a capacity of 150 tons of 3x0-in. coal per hour. Over-all plant capacity is 300 tons per hour.

NEW BYRNE COAL CO., Byrne Stop, W. Va.; contract closed with Jeffrey Mfg. Co. for rescreening plant and connecting conveyors; capacity, 75 tons per hour.

STONEGA COKE & COAL CO., Derby mine, Derby, Va.; contract closed with Koppers-Rheolaveur Co. for rescreening plant, including necessary equipment for handling 200 tons of 1½x0-in. slack from the present tipple and separating it into 1½x¾-, ¾x⅜-, ⅜-in. x 20-mesh and minus 20-mesh sizes. Mechanical vibrating screens will be installed for the ¾-in. separation and two single-surface Tyler 400 screens for the 20-mesh separation. Provision also is made for the later installation of dedusting equipment, if desired. Four bins will be provided for the four sizes made, with a vibrating degradation screen delivering to a loading boom for the 1½x¾-in. size. The plant is to be in operation by June 1.

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PERMISSIBLE PLATES ISSUED

THREE approvals of permissible equipment were issued by the U. S. Bureau of Mines in January, as follows:

La-Del Conveyor & Mfg. Co.: Model MTB-30 belt conveyor; 20-hp. motor, 500 volts, d.c.; Approval 296A; Jan. 6.

Sullivan Machinery Co.: Type 7AU mining machine (track type); 50-hp. motor; 250-500 volts, d.c.; Approvals 297 and 297A; Jan. 27.

Right of TVA to Sell Power Upheld by Supreme Court

TVA has the right to dispose of surplus power generated at Wilson Dam, the Supreme Court of the United States ruled on Feb. 17 in an eight to one decision. Justice McReynolds dissented. In upholding the decree of the Circuit Court of Appeals at New Orleans (*Coal Age*, August, 1935, p. 348), Chief Justice Hughes, who handed down the decision, said the only thing involved in the present case was the validity of a contract for the sale of transmission lines by the Alabama Power Co. to TVA. The Authority's other activities, such as land purchase, resettlement, and encouragement of wider use of electric power, were not directly affected.

"Water power, the right to convert into electric energy, and the electric energy thus produced," said the court, "constitute property belonging to the United States," and authority to dispose of property constitutionally acquired by the United States "is expressly granted to the Congress by Sec. 3, Art. IV of the Constitution.

"The constitutional provision is silent as to the method of disposing of property belonging to the United States. That method, of course, must be an appropriate means of disposition according to the nature of the property, it must be one adopted in the public interest as distinguished from private or personal ends, and we may assume that it must be consistent with the foundation principles of our dual system of government and must not be contrived to govern the concerns reserved to the States.

"The government could lease or sell [surplus energy] and fix the terms. Sales of surplus energy to the power company by the Authority continued a practice begun by the government several years before. The contemplated interchange of energy is a form of disposition and presents no questions which are essentially different from those that are pertinent to sales.

"The transmission lines which the Authority undertakes to purchase from the power company lead from the Wilson Dam to a large area within about 50 miles of the dam. These lines provide the means of distributing the electric energy, generated at the dam, to a large population. They furnish a method of reaching a market.

"We know of no constitutional ground upon which the federal government can be denied the right to seek a wider market. . . . The transmission lines for electric energy are but a facility for conveying to market that particular sort of property. . . . Certainly, the Alabama Power Co. has no constitutional right to insist that it shall be the sole purchaser of the energy generated at the Wilson Dam; that the

energy shall be sold to it or go to waste.

"The government is disposing of the energy itself, which simply is the mechanical energy, incidental to falling water at the dam, converted into the electric energy which is susceptible of transmission. The question here is simply as to the acquisition of the transmission lines as a facility for the disposal of that energy. And the government rightly conceded at the bar, in substance, that it was without constitutional authority to acquire or dispose of such energy except as it comes into being in the operation of works constructed in the exercise of some power delegated to the United States.

"These transmission lines lead directly from the dam, which has been lawfully constructed, and the question of the constitutional right of the government to acquire or operate local or urban distribution systems is not involved.

"We express no opinion as to the validity of such an effort, as to the status of any other dam or power development in the Tennessee Valley, whether connected with or apart from the Wilson Dam, or as to the validity of the Tennessee Valley Authority Act or of the claims made in the pronouncements and program of the Authority apart from the questions we have discussed in relation to the particular provisions of the contract of Jan. 4, 1934, affecting the Alabama Power Co."

Following the Supreme Court decision, work went forward at five uncompleted dams of the TVA project, and announcement of plans for still another dam was expected to be released soon. Meantime municipal power supporters in Knoxville, Chattanooga and Memphis, Tenn., began pushing plans to make TVA power available to those cities as soon as possible. Movements to this end have been under way for months, but were retarded by uncertainty on the attitude of the high court.

Plans for 75 miles of new rural lines to make TVA energy available to fourteen towns in western Tennessee were approved Feb. 5 by the Authority. E. R. Wall, project engineer, said the new lines when operated with the 26 miles of existing lines would make electric energy available to 400 farm homes in Hardin, McNairy and Chester counties, which now lack such facilities.

Research Studies Expanded

Addition of State funds to the research budget has made possible the expansion of coal hydrogenation study sponsored by Bituminous Coal Research, Inc., at Pennsylvania State College, State College, Pa. The laboratory has been enlarged and additional equipment installed, giving the laboratory more than twice the throughput capacity formerly available. During the last quarter of 1935, these studies were made: (1) continuation of pressure-temperature-conversion experiments at an initial pressure of 1900-2000 lb. per square inch; (2) using natural gas instead of hydrogen; (3) the effect of dispersion agent (tetralin) upon the course of hydrogenation. Attention will now be devoted to completion of pressure-variation experiments and of experiments on the effect of tetralin during hydrogenation, as well as to a study of the effect of separating the coal into fractions.

Mining Methods, Utilization and Safety Feature A.I.M.E. Coal Sessions

WITH utilization, operating and safety problems to the fore, the 145th meeting of the American Institute of Mining and Metallurgical Engineers, held at the Engineering Societies Building, New York City, Feb. 17-21, again brought out the latest technical and engineering thought on the major questions affecting the progress of the anthracite and bituminous industries. In keeping with this theme, specific topics of discussion included: constitution and characteristics of coal; research and distribution; prospecting, mechanical mining and ground movement; preparation and sampling; and safety, health conservation and rehabilitation of injured miners.

Data that tended to show that the ball-mill method of test for the grindability of coal tentatively adopted by the American Society for Testing Materials should be modified and improved and that the volume of the several products be taken rather than the weight, was presented by C. G. Black, chemist, central laboratory, Pittsburgh Coal Co., at the opening session, Feb. 17.

Much Dirt, Little Coal

Tests with the present tentative standard ball mill have shown that in most coals the refuse matter in the coal seam grinds more readily than the coal itself. Hence, if such impurities are present in large quantities they may increase the grindability index and lead to the erroneous conclusion that the coals themselves are more easy to grind. As what is desired is ground coal and not ground mineral matter, the coal that gives a high percentage of finely ground mineral matter, while it may appear from the screen test to be the more desirable material, is really the less desirable product, despite its fineness of comminution at some definite expenditure of power.

To compare the grindability of two coals correctly they should be ground, it would seem, said Mr. Black, to the same particle weight, but, unfortunately, when the product is lifted by air, larger particles of light material are lifted more readily than particles of heavy material of the same size; so that from equal particle weight equal particle size is not obtained.

On the other hand, it may not be well to establish standards requiring the measurement of the sizes of such fine material because it involves questionable surface factors and fine screening, which is both inaccurate and expensive. However, the surface area of the ground material is closely related to the original surface area because the nature of the coal is not altered by grinding.

Equal weights of two materials of different specific gravities but of the same particle size will contain a different number of particles and, therefore, different surface areas. Equal surface areas of the same number of particles of the same particle size will produce the same volume. The nearest practical measure of original surface area would be the volume measure, and when equal volumes of particles of the same size are reduced to the same fineness, equivalent surface areas should be produced.

Thus it can be seen that in order to get the true grindability of materials of varying specific gravities it is necessary to grind either to the same particle weight or to the same surface area. The former is impossible; the latter can be performed by taking the same surface areas as determined by a volume measure and grinding to a certain degree of fineness, which should produce the same final surface areas. It would, therefore, seem advisable to conduct the present method by taking constant original volumes and grinding them to 80 per cent minus 200-mesh by weight, and Mr. Black's address proceeded to submit evidence in support of this claim.

When mixtures of 1.60-float and 1.60-sink material are run for grindability by the constant-weight method (the tentative standard ball-mill method) there is a decrease in the number of revolutions required as the amount of 1.60-sink material increases. When these mixtures are run by the constant-volume method, there is an increase in the number of revolutions required as the amount of 1.60-sink material increases.

Ball-mill standard methods, said Mr. Black, might be shortened advantageously to three cycles. He gave records of tests to show that the results were representative of those made with more cycles, especially on coals requiring 1,000 or more revolutions, but a correction factor of 1 per cent should be applied to the result. However, in dealing with an unknown coal or one with a grindability index greater than 80 on the 50,000-index scale, a full eight-cycle test would appear advisable.

Ball-mill methods and the Hardgrove method, as adopted for tentative standards by the American Society for Testing Materials, declared the author, do not give results that can be accurately correlated. One uses impact and abrasion, the other pressure and abrasion. As the results are not comparative, one or the other method should be chosen.

Turns Vs. Percentage

Numbers of revolutions in grinding any given coal should not vary more than 3 per cent, and the variation allowable should be in the form of a percentage; not 50 revolutions, as now provided. Coals with a grindability index (50,000-scale) of 50 or under are easy to check within a few revolutions, and even coals of higher grindability will check within close limits. A test that will serve for general use is more desirable than one which requires theoretical considerations involving unreasonably costly procedure, declared R. M. Hardgrove, speaking for E. G. Bailey. What is the objective of grindability tests? asked F. A. Jordan, Youngstown Sheet & Tube Co. It arises largely, answered C. E. Lesher, vice-president, Pittsburgh Coal Co., from price fixing under the NRA. It was asserted that some coals entering the market for pulverization purposes should command a higher price, because they are more readily ground. There arose a desire to ascertain whether coal said to pulverize easily really was so superior in that respect. Was it the outcome of more suit-

able machinery, better technique, better condition of mill or an inherent quality of the coal?

Low-rank sub-bituminous coals, declared H. F. Yancey, U. S. Bureau of Mines, are extremely difficult to grind; even more difficult than anthracite. That may be due to their elasticity. No bogheads or cannels have been tested for grindability, to his knowledge.

Ball-mill methods and the Hardgrove method gave different relative values for grindability when used on three coals, one each from Pocahontas No. 3, Illinois No. 6 and Pennsylvania low-volatile anthracite, declared Dr. Yancey, for himself and M. R. Geer, University of Washington. Equating the grindability of the first coal by each method to 100, the values with the ball-mill method were 100, 51 and 31 for the three coals respectively, and with the Hardgrove method, 100, 60 and 36. The authors presented figures showing that the former method, with its alternate grinding and screening, produces sub-sieve material with only half the variation in particle size of that produced in the Hardgrove method. The average particle size, they declared, is related to the grinding characteristics of the coal. The less grindable the coal, the larger the sub-sieve material, especially with the Hardgrove method.

By mixing equal portions of anthracite and bituminous coal in grinding, it was found that the Hardgrove method was selective; the mixture did not have a grindability equal to the mean of the grindabilities of the two coals taken separately. Nor did the ball-mill method, but the result was much nearer the mean. Dr. Yancey stated that after grinding by the Hardgrove method, the minus 300-mesh material was 93 per cent bituminous and 7 per cent anthracite, though the entire mass of coal of all sizes was half anthracite and half bituminous. The coal between 14- and 28-mesh was 9 per cent bituminous and 91 per cent anthracite, showing that much of the less grindable coal had been ground but little. The ball-mill test also showed some selective grinding. With 10 per cent through a 200-mesh sieve, 80 per cent was bituminous, but with 100 per cent through that mesh, 47 per cent was bituminous and 53 anthracite.

As coals are mixtures of components, said Dr. Yancey, correct grindability results are not obtained unless equal proportions of these components are ground to the size suitable for use as powdered fuel.

Mechanical Cleaning Goes Forward

A complete statistical picture of the upward swing of mechanical cleaning in the bituminous industry was presented by L. N. Plein, U. S. Bureau of Mines, Washington, D. C. From a low point around 1920, the proportion of bituminous output mechanically cleaned rose to 5.3 per cent in 1927 and, following a rapid increase in the rate of growth starting in 1928, to 11.1 per cent in 1934.

Mines equipped with mechanical-cleaning facilities, Mr. Plein pointed out, produced 12.3 per cent of the bituminous output in 1929 and 21.2 per cent in 1934. Working time of mines equipped with mechanical-cleaning plants has been consistently higher than the average for the industry as a whole, in spite of the fact that decreases have been registered in the working time of captive mines equipped with mechanical cleaners in some years (Table I), primarily due to slackness in the steel industry.

Table I—Comparison of Working Time at Mines Equipped With Mechanical Cleaning With All Mines in the Bituminous Industry

	All Bituminous Mines	Mines with Mechanical Cleaners		
		All so Equipped	Captive Only	Commercial Only
1929	219	244	249	243
1930	187	202	206	201
1931	160	169	145	173
1932	146	153	98	161
1933	167	182	142	187
1934	178	204	180	207

Doubt was expressed by H. E. Nold, professor of mining engineering, Ohio State University, in a written discussion read by H. F. Hebley, coal preparation engineer, Commercial Testing & Engineering Co., Chicago, as to consumer reaction to ultra refinements in screening and the production of a wide variety of sizes and mixtures, although he felt that many consumers had found mechanical cleaning a benefit. While it is obvious, he stated, that the consumer can afford to pay more for mechanically cleaned coal, the fact that he will pay more is not so obvious.

Much of the increase in mechanically cleaned output since 1927 can be credited to the adoption of new types of mechanical cleaners, observed J. B. Morrow, preparation manager, Pittsburgh Coal Co. Trying to make one particular type of equipment answer all the problems encountered at any one plant, he declared, is giving away to a greater appreciation of the fact that combinations of various types of equipment, each fitted to the job to be performed, is more efficient and less costly.

Banded Ingredients Studied

Presenting a progress report on a study of the distribution of banded ingredients in Illinois screenings and the method of determining such distribution, bearing the title of "Concentration of the Branded Ingredients of Illinois Coals by Screen Sizing and Washing," L. C. McCabe, assistant geologist, coal division, Illinois State Geological Survey, pointed out that "preparation for or actual small-scale use of the separated ingredients in the manufacture of domestic and electrode coke, in hydrogenation, and for diesel fuel has been reported by European investigators." However, said Mr. McCabe, "the greatest obstacle to closer control of the character of coal, in so far as it may be brought about by regulating the distribution of the banded ingredients, is in the relatively low price received for the coal and the high cost that would be involved in special methods of preparation." On the other hand, "systematic study of coal, employing the methods used in the best metal-mining practice, may throw much light on the constitution and behavior of the fuel." Much proving with the microscope remains to be done, however, before the response of coal to physical handling can be predicted.

Lack of markets for the banded materials is the most important factor bearing on future progress in this field, declared D. R. Mitchell, department of mining engineering, University of Illinois, in a written discussion read by Clayton Ball, Bell & Zoller Coal & Mining Co., Zeigler, Ill. If suitable markets were assured, an economical and feasible process of concentration could be developed.

Commenting on the increase in vitrain percentage with decrease in size brought out in the paper, Mr. Hebley quoted a statement by Dr. Gordon, who, in describing the type of coal most easily treated by the Bergius process, declared that "the bright coal is the most easily hydrogenated portion of any given coal, and, fortunately, this fraction is the one which preponderates in a well-cleaned slack coal." This statement, said Mr. Hebley, bears out the results of the Illinois investigation. Furthermore, these results show that the ash content of the minus 10-mesh material floating at 1.30 is approximately the same as the 2½-per-cent ash content of the Chance-cleaned coal used in the Billingham-on-Tees (England) hydrogenation plant.

Installation of plants yielding both an ultra-clean (say float at 1.30) product with an ash content of 1½ to 2 per cent and a secondary product for steam generation with an ash content of 8 to 10 per cent is a future possibility, Mr. Hebley stated. "The low-ash coal with a high percentage of vitrain may yield a good coke of low

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A.I.M.E. Officers

John Mount Lovejoy, president, Seaboard Oil Co., New York City, has been elected president of the American Institute of Mining and Metallurgical Engineers, succeeding H. A. Buehler, state geologist and director, Missouri Bureau of Geology and Mines. Roland C. Allen, vice-president, Oglebay, Norton & Co., Cleveland, Ohio; Henry Krumb, consulting mining engineer, Salt Lake City, Utah; and Wilfred Sykes, assistant to the president, Inland Steel Co., Chicago, have been chosen vice-presidents. Directors elected, some for second terms, are: Erskine Ramsay, chairman of the board, Alabama By-Products Corporation, Birmingham, Ala.; Eli T. Conner, mining engineer, Scranton, Pa.; John L. Christie, metallurgist, Bridgeport, Conn.; Selwyn G. Blaylock, vice-president, Consolidated Mining & Smelting Co., Trail, B. C.; Frank L. Sizer, mining engineer, San Francisco, Calif.; and William B. Heroy, oil geologist, New York City.

Eugene McAuliffe, president, Union Pacific Coal Co., Omaha, Neb., heads the Coal Division, succeeding John T. Ryan, vice-president, Mine Safety Appliances Co., Pittsburgh, Pa. J. B. Morrow, preparation manager, Pittsburgh Coal Co., Pittsburgh, Pa., is vice-chairman, and H. E. Nold, professor of mining engineering, Ohio State University, Columbus, is secretary-treasurer. E. A. Holbrook, dean of the school of engineering and mines, University of Pittsburgh; Edmund L. Dana, mining engineer, Haddock Mining Co.; and Otto Herres, Jr., vice-president, United States Fuel Co., were elected to the executive committee.

ash content." Also, "it is interesting to note that the larger sizes are composed of banded ingredients, but that at 10-mesh the constituents are unlocked and separations can be made. And if the minus 200-mesh is removed, the fusain is less than 10 per cent."

Separation of fine material through the use of screens was discussed by George R. Delamater, W. S. Tyler Co., Cleveland, Ohio. Screens have been used in combination with air separation both before and after at the New Orient (Illinois) plant of the Chicago, Wilmington & Franklin Coal Co. At a Logan County (West Virginia) operation, separation is being made at 20-mesh, removing 75 per cent of the undersize from ¾-in. slack running 5 to 6 per cent moisture on one 4x8-ft. screen handling 35 tons per hour. Some experimental work in Ohio involved the screening of 50 cars at 28-mesh, which was done without brushing the screens at 5 per cent moisture. Over that, "skinning over" on top of the screen was encountered. At a southern Indiana strip mine, where coal sometimes is dug from under water, wet screening of the 1½-in. slack at ⅜ in. was adopted. Later, the point of separation was changed to 10-mesh. In the latter case, undersize in the screen product averages 2½ per cent. Three 4x8-ft. screens handle a maximum of 330 tons per hour.

Data on fuel movements into the market territory served by Illinois coals presented at the 1935 meeting of the Coal Division, held at St. Louis, Mo. (*Coal Age,* December, 1935, p. 543), was summarized by Walter H. Voskuil, mineral economist, Illinois State Geological Survey, as a preface to a general discussion of the paper, which brought out a unanimous opinion that additional and more detailed studies of fuel origin and distribution are vitally important to the future course of the coal industry.

Mechanization in the Pittsburgh No. 8 coal field of eastern Ohio, said John H. Richards, chief mining engineer, Hanna Coal Co., St. Clairsville, Ohio, has been extended not only to the five major steps in coal production—cutting, drilling and shooting, loading, haulage, and surface preparation—but to sharpening bits, Guniting (mechanical "timbering") and the use of welded rails (mechanical "track laying"). Approximately 3,500 ft. of welded track has been installed at one of the Hanna mines. Hanna's Fairpoint No. 9 mechanical mine—which averages 2,250 tons per day of three shifts with 89 mine cars—accounted for 710,000 out of the total of 1,136,000 tons loaded by mobile machines in Ohio in 1934, Mr. Richards stated in the course of a lecture accompanying a motion picture of underground and surface activities at Fairpoint.

Research Must Lead Application

Contrary to experience in many other activities, developments in the utilization of coal have proceeded without any material scientific basis, declared H. H. Lowry, director, coal research laboratory, Carnegie Institute of Technology, Pittsburgh, Pa., in a discussion of the need for coal research. "This lack of scientific research on the utlization of our most important natural resource—coal—undoubtedly has been due in large part to the reluctance of investigators to study the interrelationships involved in the complicated processes in which coal is used. These complexities are made more difficult to unravel by the undetermined, and so far indeterminable, chemical constitution of coal."

A comprehensive program of combustion research, Dr. Lowry stated, should include the following studies:

1. The specific requirements of temperature, volume of heat, uniformity of temperature, cleanliness, type of heat transfer, etc., for use of coal in domestic heating, and power and industrial heating.

2. The appliances available for burning coal for different purposes to determine their limiting characteristics with respect to completeness of combustion, effect on ash clinkering, effect of caking of coal, draft requirements, and refractory maintenance, and also to determine their convenience characteristics with respect to regulation, flexibility, and handling of fuel and ashes.

3. The effect of storage, of size stability, of handling and heating, and of grindability on the suitability of coals of different ranks and grades for use in different types of equipment.

4. Heat and fluid transfer in granular masses such as a fuel bed.

5. The mechanism of thermal decomposition of coal, since the action of heat on coal is an essential part of the combustion process and the method of its application may determine the furnace volume required for complete combustion of the liberated volatile matter and the combustion characteristics of the fuel on the grate.

6. The mechanism of combustion of the volatile matter liberated in the combustion process to make possible the most economical design of furnace for complete combustion.

7. The nature of the reaction between the solid fuel on the grates, or in suspension, and the oxidizing gas, and how this reaction is influenced by ash or added catalysts.

The carbonization process, on the other hand, is somewhat better understood than the combustion process, but more fundamental research is necessary for accomplishment of the ultimate aim, which should be ability:

1. To examine a given coal and predict with scientific accuracy the yields and nature of the products obtained in any given coke oven under any given operating condition.

2. To increase the range in choice of coals for the carbonization process.

3. To indicate the maximum monetary return from the products obtained.

Coming Meetings

- Central West Virginia Coal Mining Institute: annual meeting, March 7, Waldo Hotel, Clarksburg, W. Va.

- Canadian Institute of Mining and Metallurgy: annual meeting, March 17-19, Chateau Laurier, Ottawa, Ont., Can.

- Fourth Annual Mineral Industries Conference of Illinois; April 24-25, Urbana, Ill.

- American Mining Congress: annual convention and exposition, May 11-15, Cincinnati, Ohio.

- Big Sandy-Elkhorn Coal Operators' Association: annual meeting, June 2, Ashland, Ky.

- Illinois Mining Institute: 18th annual boat trip and summer meeting, June 5-7, on Str. "Golden Eagle," leaving St. Louis, Mo., at 11 p.m., June 5, and returning to St. Louis at 10 a.m., June 7.

- Mine Inspectors' Institute of America: 27th annual convention, June 29-30 and July 1, Shirley-Savoy Hotel, Denver, Colo.

4. To decrease the net cost of the process itself.

Progress in coal hydrogenation, Dr. Lowry pointed out, has been great, but at the same time has been made through largely empirical, though systematic, methods. As in the case of carbonization, study of the chemical composition of coal assumes greater importance than the combustion process. To this must be added a better understanding of the hydrogenation process itself.

Remarking that stoker and equipment manufacturers are designing coal-burning equipment without any material knowledge of the fundamentals of combustion, J. E. Tobey, manager, fuel engineering department, Appalachian Coals, Inc., Cincinnati, Ohio, expressed the opinion that research of a fundamental nature could throw considerable light on the action of coal on a stoker, the plastic properties of coal as related to combustion and the dissimilar behavior of similar coals and thus simplify the problem of equipment application.

Agreement with previous recommendations for fundamental research on the nature of coal and the reactions occurring during utilization was expressed by A. C. Fieldner, chief engineer, experiment stations division, U. S. Bureau of Mines, Washington, D. C., who cited particular difficulties in the design and operation of carbonizing plants growing out of lack of knowledge of the plastic properties of different coals and the behavior of coal when subjected to heat. Difficulties in blast-furnace operation and design were compared with those attending design and operation of combustion equipment by Ralph H. Sweetser, consulting engineer, blast-furnace practice, New York City.

Oxygen Improves Gas Quality

Advances in the art of oxygen production and consequent reduction in cost, particularly of a gas of 95-per-cent purity, open up the possibility of using oxygen in the production of producer gas with a minimum of nitrogen dilution and consequently a flame temperature high enough for modern open-hearth practice, was the conclusion of Theodore Nagel, vice-president, Carburetted Gas, Inc., New York City. Offering specimen calculations of the relative values and costs of reduced-nitrogen-producer gas and other gaseous fuels in open-hearth practice, Mr. Nagel pointed out that this development offered the possibility of a return of producer gas to the position gradually being taken over by fuel oil, natural gas and coke-oven gas.

Utilization of coal reserves of steel companies which at the present stage of the art are not subject to economical development was seen by Mr. Sweetser as one possibility of the process. Dr. Lowry offered a digest of opinions by various authorities on the feasibility of using oxygen in producer-gas manufacture, the cost of usng oxygen for such a purpose, the possibility of increased consumption of bituminous coal through oxygen-producer technique, and the relation of the process to the steel plant. General adoption of the oxygen method of gas production would require bigger and better producers, declared B. F. Wood, New York City, and might be extended to gas production for boiler use, thus avoiding the drawbacks attending the use of coal in a solid state.

Collection of the gross sample is the most

difficult problem in coal sampling, declared W. A. Selvig, chemist, Pittsburgh (Pa.) experiment station, U. S. Bureau of Mines, in opening the discussion of "Variables in Coal Sampling," presented at the 1935 annual meeting (*Coal Age*, March, 1935, pp. 127, 128) by J. B. Morrow, preparation manager, and C. P. Proctor, chief chemist, Pittsburgh Coal Co., Pittsburgh, Pa. Laboratory preparation for analysis presents the least difficulties. In reduction of the gross sample, the third problem, handling the standard sample of 1,000 lb., represents a considerable expense, which might be reduced by the employment of mechanical methods. Mechanical methods also would eliminate the personal equation, and these considerations strongly support the relegation of the hand method to the optional classification.

Selection of one-quarter as the final sample might result in questions as to accuracy, said J. F. Barkley, supervising engineer, U. S. Bureau of Mines, Washington, D. C., who also expressed doubt of the value of the recommendation that sample size be reduced and greater weight given to the element of "commercial accuracy." Perhaps the solution might be the initiation of a campaign for more crushers—without splitters—to reduce the sample to ¼ in. Loss of moisture in crushing is a weakness of the present standard for moisture determination pointing to a need for revision.

Since doing the work on which the original paper was presented, said Mr. Morrow, sampling cost has been reduced approximately one-third by his organization through the elimination of useless steps. For ordinary plant work, he felt, smaller samples, if handled with greater care, are, in general, satisfactory.

Finest Dust Mostly Fusain

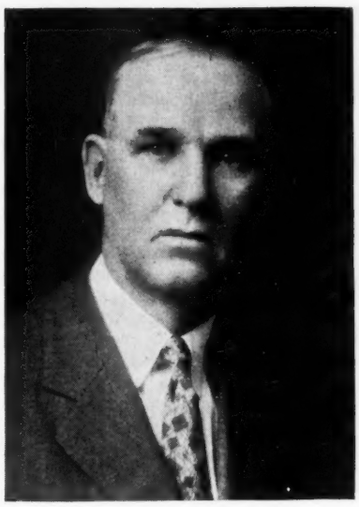
Fusain, or what is known as "mineral charcoal," forms about 75 per cent of the minus 200-mesh material when coal dust from the deduster at Orient No. 2 mine, of the Chicago, Wilmington & Franklin Coal Co., West Frankfort, Ill., is screened, declared Gilbert Thiessen, associate chemist, Illinois Geological Survey, at the Tuesday afternoon session, with Cadwallader Evans, general manager, Hudson Coal Co., in the chair. The minus 200-mesh material constitutes about half the dust from the dedusting plant; 86 per cent of the fusain in the dust is found in that fraction.

Tests of the coal mentioned show the face samples have 0.004 per cent of phosphorus, the dedusted fine coal has 0.012 per cent, and the minus 200-mesh dust, 0.008, declared Dr. Thiessen.

Generalizations about fusain are dangerous, said J. B. Morrow, preparation manager, Pittsburgh Coal Co., for fusains vary. Some fusain is hard, some soft; some has 30 per cent of moisture, yet appears quite dry. He did not believe that fusain in Pittsburgh coal has more phosphorus that face coal. The phosphorus is in the ash and not in the coal, for most of it is in the high-ash fractions.

Phosphorus has been found in somewhat excessive quantity in the top 15 in. of the Pittsburgh seam, added Mr. Morrow. This impurity seems inherent and cannot be removed. It also appears in the bottom 6 in., where, however, it can be reduced.

Benches high in detrital clay are high in phosphorus, stated Mr. Ball in the course of remarks confirming Mr. Morrow's suggestion that the phosphorus was in the mineral matter. He had found some apatite crystals. Mr. Jordan declared phosphorus could not be organic, for it was removable.



Eugene McAuliffe
New Coal Division Chairman

Metalliferous ores and silicate minerals, declared J. T. Crawford, preparation department, Pittsburgh Coal Co., may give best results in flotation when the pulp density is about 20 to 30 per cent solids, but the number of particles per cubic unit is the best criterion. Coal, being light, has more particles per cent of solids than ores and gangues and, moreover, 50 to 90 per cent of the total tonnage must be floated, so a density of at or near 12 per cent solids gives the best results with coal.

A mantle of soil and disintegrated rock from 1 to 40 ft. thick, known as "wash," overlies bedrock in the Mahanoy region. Earth-resistivity methods have been employed to determine the locations of the outcrops at the top of the bedrock, said Maurice Ewing, Lehigh University, delivering a paper prepared by himself, A. P. Crary, J. W. Peoples and J. A. Peoples, Jr., at the Wednesday morning session, over which L. E. Young, vice-president in charge of operations, Pittsburgh Coal Co., presided.

How Coal Seams Were Located

In this instance, four iron stakes were driven in the ground at 20-ft. centers. A current was made to travel down one of the outer stakes through the ground to the other outer stake, and the current established between the inner two stakes was measured. It is preferable to place the stakes parallel to the strike of the coal measures. As the resistivity of anthracite is found in some localities to be about 0.0001 megohm-centimeter, and that of shales and sandstones 1 to 200 megohm-centimeters, wherever such anthracite beds approach the surface, resistivity is lower than where the current has to travel through rocky measures. By locating the points of lowest resistivity, the outcrop can be determined, but the coal must be markedly lower in resistivity than the beds of rock above and below it.

Unfortunately, not all anthracite has the low resistivity noted in the Mahanoy district. Apparently resistivity augments with an increase in volatile-matter content, but little further increase occurs between the Shamokin type of anthracite and bituminous coal from the New River district of West Virginia. Some anthracites have a greater resistivity than beds of associated rock.

Geophysical surveys indicate where to drill for coal and consequently save the needless expense of drilling where seams do not crop or where coal has been extracted. Surveys also were made by the authors to ascertain the depth of the coal. Here the distances between iron stakes were successively increased, the stakes being kept in the same line.

Referring to his early attempts to map the outcrops around Wilkes-Barre in 1921, S. F. Kelly, Combined Geophysical Methods, Inc., said he used the spontaneous-polarization method. Where a body of mineral projects from a reducing level, such as exists at depth, to an oxidizing level, such as is found near the surface, currents are induced between mineral in the lower level and mineral near the surface. By measuring these currents, small as they are, the mineral outcrop can be located. Unfortunately, certain needed corrective factors were not provided when the survey was made.

What in Seam Carries Current

Fusain, said Mr. Kelly, has been found in anthracite, where it forms graphitic layers along which electricity flows with relative freedom. Coal itself is not a good conductor. Laminated anthracite has such fusain, which fits it for earth-resistivity methods.

Referring to the method described in the article of Dr. Ewing and associates, he said that, if the anthracite bed has a higher resistivity than the associated rocks, the line of iron stakes should be across the line of strike; otherwise, the current might travel in the rock and not cross the highly resistant coal bed, the resistivity of which is to be measured.

A survey of coal fields by geophysical methods was probable, commented G. H. Ashley, state geologist of Pennsylvania. Kansas was doing such work on coal masked by glacial drift. Difficulties in such work where water was present to change resistivities were emphasized by R. H. Knapp, assistant engineer, Philadelphia & Reading Coal & Iron Co. Sometimes the drill does not strike coal where minimum resistivities have been found. In reply, it was stated that excellent results had been obtained even in rainy weather. The survey found a spoon-shaped basin of the Orchard seam which neither mining nor drilling had revealed.

Use of reflected sunlight for photographing the interiors of shafts from the surface was described by W. W. Fleming, district mining supervisor, U. S. Geological Survey. One or two mirrors are held at the top of the shaft and moved so that the light will traverse and illuminate equally every part of the walls. The aperture of the camera is set at about F 32, and then the lens shutter opened. Wetting the walls increases reflection.

So many lives are lost in entering shafts which too late are found to be filled with irrespirable gases that this method will be helpful in determining the condition of abandoned shafts and in performing rescue work, declared J. J. Rutledge, chief min-

ing engineer, State of Maryland. It will also show, said one, where water is entering a shaft. Reflected light has thus been used in wells. Moving reflected light over the subject to be photographed has many possibilities.

Prior to opening the session of the Ground Movement and Subsidence Committee meeting, Thursday morning, Dr. Rice, the chairman, described observations during a trip to the International Testing Stations Conference at Dortmund, Germany. In Germany no new installations of gasoline locomotives are permitted, but diesel-oil locomotives are being quite actively operated. England has had one on trial for about nine months. He is interested, he said, in this development as a way of supplanting trolley locomotives, it having the advantage of greater safety and lower cost. An excess of air is used, and the exhaust of the engine does not exceed 1 per cent carbon monoxide. The intake is protected by gauze and sprays cool the exhaust so that gas cannot be ignited.

Determining Roof Action

Continuous records are needed for determining just what is happening in the mine when coal is being removed. Surveys and levels taken on the surface at long intervals are of little value, declared H. Landsberg, Pennsylvania State College. A simplified convergence recorder has been used to note the approach of roof to floor during mining in No. 9 mine of the Rockhill Coal & Iron Co.

Two tubes with sliding fit are pressed against floor and roof by a spring. The upper tube has a recording pen which marks a line on a recording drum attached to the lower tube. The instrument was installed about 8 ft. from a breakline where the last pillar was being extracted. A sharp convergence occurred after about two hours, but no change was noted during the next six. In the next eleven hours, convergence steadily increased, after which the action was rapid, and shortly thereafter a break occurred and the roof fell. The instrument was recovered without damage. Similar tests were made at No. 1 mine of the same company, at Robertsdale, Pa.

Dr. Landsberg suggests that the normal action of the roof is affected by tidal forces, shooting, incessant vibration known as microseisms and earthquakes. Dr. Rice declared that severe quakes in Montana had not injured the mines. In Japan, an earthquake caused a cliff to fall, but the offshiftmen who left the mine soon after did not know the quake had occurred. The Long Beach earthquake in California had no effect on wells. When a row of billiard balls is struck only the last one travels far. So only the surface suffers from the jar of an earthquake. But the Crows Nest disturbance, started by caving, was felt in the mines nine miles away.

At Montour No. 10 of the Pittsburgh Coal Co., the Bureau of Mines set its convergence recorder in a small pit in the floor and in a recess in the roof to get down and up respectively to solid measures. Dr. Young said that at Montour No. 10, coal was taken in slabs off the outby side of a butt-off driven in the pillar. As butt-offs were expensive to construct, if one more slabbing could be taken than it was now thought safe to take, the method would be profitable. A recorder was needed to indicate just when it was time to desist slabbing and make another butt-off.

A longwall face 600 ft. long appeared to have solved the problem of bumps in a Harlan County (Kentucky) mine, declared J. F. Bryson, Department of Mines, Kentucky. Cover was 1,400 ft. thick, of which 70 to 90 ft. over the coal was sandstone. Chocks filled with bags of coal cuttings were used to let roof down gradually. Inspection showed frequent small cracks, apparently extending up only a few feet, paralleling the longwall face, and large cracks about 300 ft. apart, wide and high. Since the change to longwall was made no accidents had occurred, though before that time it had been impossible to remove any of the coal owing to repeated bumps.

Describing his studies in Germany, Dr. Rice said that the German mines no longer tried to backfill completely. Caving systems were being installed. In Central France, with coal 30 to 50 ft. thick, ⅜x4-in. steel bands were being used, a meter apart over the crossbars, supporting the roof where the beds were being excavated in steps, and the lower steps were under gobbed material. The bands were unrolled as needed. Wire rope had been used, but deflection could not be avoided. Bands of steel laid flat without deflection.

Health and safety were the subject of two sessions bringing out the viewpoints of representatives of the coal, metallic, non-metallic and quarrying industries on major problems of today. Setting the pace, Daniel Harrington, chief, health and safety branch, U. S. Bureau of Mines, Washington, D. C., reviewed briefly the present status of the safety movement in the mining industries and the trend of injuries arising out of the major hazards encountered.

In judging safety contests in Indiana, reported C. A. Herbert, supervising engineer, U. S. Bureau of Mines, Vincennes, Ind., it was felt that both frequency and severity rates, rather than one or the other, should be used in some weighted combination. Little control can be exercised over the severity of an injury, and, while frequency is subject to a considerable measure of control, all injuries have equal weight in computing the rate. Thus, because certain classes of injuries which may result in only a few days' lost time are not so subject to control, using frequency alone would penalize certain operations where much effort had been expended and the severe type of injury largely eliminated. Consequently, both frequency and severity were included in grading Indiana contests by placing both on a percentage basis with 100 representing a perfect grade.

Grading Safety in Indiana

Maximum allowable frequency and severity rates of 200 and 20, respectively, were established, and all mines with higher rates were disbarred. Grades are calculated as follows: frequency, divide frequency rate by two and subtract from 100, which is equivalent to zero frequency; severity, multiply rate by five and subtract from 100. Combined grade for determination of the standing of contestants is determined by adding the products resulting from multiplication of the frequency and severity grades by their respective weighted values, namely: frequency, 0.8; severity, 0.2. Where more than one contestant receives the same grade, the one with the highest man-hours of exposure is considered as having the highest score.

In the ensuing discussion, inclusion of the element of potential hazard in rating safety results was advocated by B. F. Tillson, consulting engineer, Upper Montclair, N. J., while R. N. Hosler, superintendent, coal-mine section, Pennsylvania Compensation Rating and Inspection Bureau, Harrisburg, Pa., felt that three factors should be considered in determining contest results: frequency, as every injury is a potential fatality; cost; and severity—least important, as severity often is determined by the manner of treating the injury.

Drawing on his company's experience to illustrate his points, Fred A. Krafft, director of employee relations, Consolidation Coal Co., Fairmont, W. Va., presented an exhaustive analysis of the factors involved in the development of medical and health programs for coal-mine employees and communities and the benefits to be derived from such programs. Major points considered in detail by Mr. Krafft included basis of payment for service by employer and employee; employment of company or contract doctors; measure of service to be rendered the employee and his family; standards of housing and sanitation to be adopted by the company; what type of public-health service and education should be maintained by the company; hospitaliza-

Keeping Step With Coal Demand

Bituminous Production

Week Ended:	1936 (1,000 Tons)	1935* (1,000 Tons)
Jan. 4	8,210	7,377
Jan. 11	9,966	7,824
Jan. 18	8,546	7,916
Jan. 25	8,270	8,416
Feb. 1	8,900	8,663
Feb. 8	10,100	8,737
Feb. 15	10,400	8,705
Total to Feb. 15	60,045	56,278†
Month of January	38,600	36,681

Anthracite Production

Jan. 4	1,176	1,108
Jan. 11	1,245	1,201
Jan. 18	1,013	1,245
Jan. 25	1,037	1,336
Feb. 1	1,483	1,444
Feb. 8	1,606	1,456
Feb. 15	1,535	1,157
Total to Feb. 15	8,586	8,712†
Month of January	5,219	5,691

*Outputs in this column are for the weeks corresponding to those in 1936, although these weeks do not necessarily end on the same dates.

†Total in 1935 includes one more day than in 1936.

Bituminous Coal Stocks

	Thousands of Net Tons Jan. 1, 1936	Dec. 1, 1935	Jan. 1, 1935
Electric utilities	6,174	6,438	5,507
Byproduct ovens	5,559	6,129	5,577
Steel and rolling mills	954	958	817
Railroads (Class I)	5,589	5,865	4,856
Other industrial*	10,363	11,151	8,619
Total industrial	28,639	30,541	25,376
Retail dealers	8,300	9,370	9,100
Grand Total	36,939	39,911	34,476

*Including coal-gas retorts and cement mills.

Bituminous Industrial Consumption

	Thousands of Net Tons Dec., 1935	Nov., 1935	Dec. 1934
Electric utilities	3,303	3,071	2,722
Byproduct ovens	4,850	4,488	3,503
Steel and rolling mills	1,117	974	942
Railroads (Class I)	7,390	6,640	6,816
Other industrials*	9,983	9,033	8,817
Total industrial	26,643	24,206	22,800

*Including beehive coke ovens, coal-gas retorts and cement mills.

tion measures to be afforded the employee and his family; and physical examination of applicants for positions and employees.

Citing experience in Maryland, where 60 per cent of the serious injuries result from falls of roof, Dr. J. J. Rutledge, chief mine engineer, Maryland Bureau of Mines, expressed the opinion that serious application to the question can accomplish a substantial measure of rehabilitation of men suffering broken backs if the spinal cord has not been severed, with consequent reduction in the cost of supporting the men and their families. An important step is immediate X-ray examination supplemented by study of the results by a competent orthopedic surgeon. If this is not done, there is a strong possibility that the door to rehabilitation will be closed. A second important factor is providing the injured man with a light occupation to keep his interest aroused and provide him with an income. Of fifteen cases studied in Maryland, about half of the men are now able to get about and earn some money.

Extension of Bureau's Work Urged by Advisory Board

The need of continuing efforts for safety and prevention of mine accidents and extension of the study of silicosis by the U. S. Bureau of Mines were emphasized in the reports and recommendations of the advisory board of the Bureau, which met Feb. 6 in Washington. The board, which was named early in 1935 (*Coal Age*, April, 1935, p. 166), also advised that existing mine experiment stations be continued, but that no new stations be considered until after thorough and careful consideration. A survey of coal distribution from the various producing fields and a survey of crude oil in storage were particularly recommended. Accomplishments of the Bureau during the last year, under the direction of Director John W. Finch, were highly commended. Among the committees to be appointed for the coming year are those on safety and health, coal investigations, mining problems, petroleum and gas problems, and economics and statistics.

Expands Coal Service

A broadened service covering all phases of coal, its preparation for market and its utilization is announced by the Commercial Testing & Engineering Co., Chicago, following the association of Henry F. Hebley with the company's organization. Mr. Hebley, for a number of years a member of the Allen & Garcia Co. staff, has assumed the position of engineer on coal preparation with the Commercial company.

Bethlehem Mines Renamed

Industrial Collieries Corporation is the new name of the coal-mining subsidiary of the Bethlehem Steel Corporation. The new name, which displaces Bethlehem Mines Corporation, was adopted as of Feb. 1. Coincident with this change, the title of T. R. Johns became general manager instead of general manager of coal mines.

Commission Presses Price-Coordination Drive; Three Districts Announce Agreements

WASHINGTON, D. C., Feb. 21—Increasing pressure to speed up the work of price coordination prescribed in the Guffey-Snyder act has been exerted upon district boards in Minimum-Price Area No. 1 during the past fortnight by the National Bituminous Coal Commission. Members of the board for District 4 (Ohio) were ordered to appear at a public hearing Feb. 14 and tell why that district had submitted a price schedule to the Commission without voting on it. Explanations that no vote had been taken because of sharp differences of opinion among the board members fell upon unreceptive ears. Failure of northern West Virginia (District 3) to compose its differences with competing fields also drew unfavorable comment, and Charles O'Neill, chairman of District 1 (eastern Pennsylvania), publicly charged conferees from some of the district boards with deliberately "stalling" in correlation meetings.

The hearing at which these views were aired, however, also brought the announcement that agreements on coordination had been reached between Districts 1, 7 (Southern low-volatile fields) and 8 (Southern high-volatile fields). These agreements, stated Irvin Davis, chairman of District 8, cover about 153,000,000 tons, or approximately 64 per cent of the commercial output of Districts 1 to 8 inclusive. Districts 1, 7 and 8, declared their spokesmen, were ready to carry on with the other districts in Minimum-Price Area No. 1 as soon as those other districts had settled their internal problems. Further hearing on the schedules was set for Feb. 24. In view of the "substantial progress" already made in correlation, said a press release issued following the sessions last Friday, "it is anticipated that the Commission will be in a position, after the hearing on Feb. 24, to take formal action on the proposed minimum prices."

Price Hearings Continued

Next Monday's meeting will be the third formal public hearing which the Commission has held to consider coordination progress in Minimum-Price Area No. 1. The first of the series, originally set for Jan. 20, was postponed until Feb. 10 to give the districts more time to work out their problems. Although the Commission expressed optimism over the developments reported at the Feb. 10 hearing, a continuation of that hearing on Feb. 14 was ordered in the hope that by that time the district boards would be "in general agreement as to coordinated prices recommended to the Commission for approval, disapproval or modification." Between public hearings, members of the Commission have been busy in informal meetings and private hearings with various district board representatives.

When the public hearing reconvened on Feb. 14, progress reports from the districts in Minimum-Price Area No. 1 were sidetracked temporarily while the Commission grilled members of the Ohio district board for their failure to take a formal vote on the minimum-price schedules they had transmitted to Washington late in January. One by one the seven Ohio board members present were called to the witness chair and questioned by Charles F. Hosford, Jr., chairman of the Commission, who stated that the situation which had arisen in Ohio was a matter of serious concern to the Commission.

"It should not be necessary," he added, "to direct attention to the law, which creates 23 districts, each having a board of producers charged with specific duties. These duties are as definite and as important as the work of the Commission and performances of these duties is as necessary as the functions of the Commission. However, it is obvious that, unless the district boards perform their duties in an impartial manner, they will seriously interfere with the effective administration of the act. The Commission," he warned, "cannot and will not ignore failure of any district board to act."

Ohio Board Approves Schedules

Possibilities of a definite break between the Commission and the Ohio group, however, were averted when announcement was made at the afternoon session by Ezra Van Horn, District 4 chairman, that approval had been given to the price schedules at issue, as well as classification bases and size groupings, at a board meeting held following the morning session. Storm signals were run up by another district in the afternoon when Mr. O'Neill, joining in the rejection of a suggestion that consolidation of some of the battling districts might simplify the problem of coordination, declared that such a merger would not be helpful and stated that District 1 would resist such a step "with all the power it had." Consolidation, he explained, would only intensify the difficulties of coordination because of differences in coals, wage scales and freight rates between competing districts.

The Commission has approved the finding of the weighted average of the total cost of the tonnage in minimum-price areas Nos. 3 (Arkansas-Oklahoma) and 6 (Wyoming-Utah) in the calendar year 1934. The figures are $3.87 and $2.53 per net ton respectively.

Adjusted minimum price schedules for Colorado and New Mexico coals, approved Feb. 21 by the Commission, show a slight revision in the light of final cost determinations and operating experience under former schedules, in effect since Dec. 6, 1935. For the northern Colorado area (District 16), the new minima range from $1.25 per ton in one section and $1.65 in most sections for slack to $4.50 for lump, compared with the former range of $1.65 to $4.75, respectively; southern Colorado (District 17), $1.25 to $4.50 (8 in.), against $1 to $4.35; New Mexico (District 18), $1 to $4.65, against $1 to $4.50.

Proposed minimum prices for Utah and Wyoming will be considered at a hearing to be held Feb. 27 in Denver, Colo. At the same time and place a hearing will be held to determine whether a competitive relationship exists between Minimum-Price Areas 8 (Montana) and 6 (Utah and Wyoming) which would necessitate a coordination of prices between the two areas.

About 75 per cent of the tax levied on coal

output by the Guffey act has been withheld from the government and impounded in court depositories, the Internal Revenue Department reports. Taxes on November production fell due Jan. 2 and January receipts from the tax were $249,553. With an output of 32,285,000 tons in November, according to the National Coal Association, and using as a base price the 1934 average of $1.75 a ton, the receipts should have been about $873,731.

Appointments of the five members of the Commission and two members of the Bituminous Coal Labor Board, named Sept. 20 by President Roosevelt, as well as the Consumers' Counsel, were confirmed Feb. 12 by the Senate. The Labor Board members are John J. O'Leary, international executive board member, District 5 (Pittsburgh, Pa.), United Mine Workers, representing the employees, and Lee C. Gunter, executive vice-president, Southern Appalachian Coal Operators' Association, producer representative. Former Judge John M. Paris, New Albany, Ind., who was named to represent the public, declined to serve.

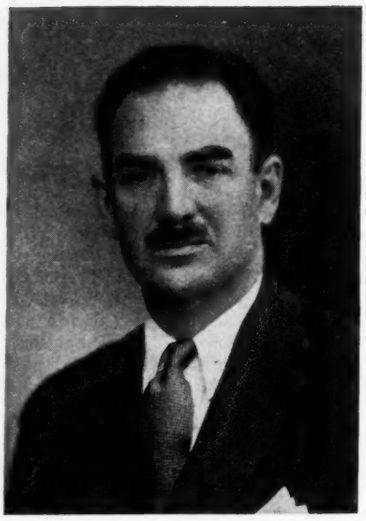
The protest of the Progressive Miners against the appointment of Ray Edmundson, president, District 11, U.M.W., as labor member of the Illinois district producers' board, was rejected by the Commission on Jan. 30. In confirming Mr. Edmundson's appointment the Commission stated it had found that the United Mine Workers represents the majority of miners in Illinois.

Suits to restrain collection of taxes under the Guffey act were filed by more than a score of companies during the last month. Sixteen companies in Utah which have signed the code alleged that they did so because of the "coercive provisions" of the law and charge that the tax is really a penalty. Three New Mexico companies, which took similar action, declared that the tax is excessive and destructive in that profits would be less than the tax. In asking a restraining order pending determination of the law's constitutionality, the Hatfield-Campbell Creek Coal Co., operating in West Virginia, pointed out that approximately 200 companies in its field are members with it under the code, and stated that the suit was filed in their behalf in case they chose to intervene.

Restraining Order Dissolved

Holding that code members will have adequate remedy at law to recover the 1½ per cent tax if the law is declared unconstitutional, Judge John Paul, in the federal court for the western district of Virginia, refused on Jan. 28 to grant a temporary injunction to the Jewell Ridge Coal Corporation against collection of the tax. The court also declared that a preliminary restraining order granted Dec. 31 would be dissolved. Judge Paul's memorandum pointed out that his decision similarly affected the Virginia Iron, Coal & Coke Co. and the Benedict Coal Corporation.

Federal Judge George McClintic, at Charleston, W. Va., granted a restraining order to the Carbon Fuel Co. and the Winifrede Collieries Co., but directed the companies to deposit with the court the amounts they would have to pay as assessments pending final ruling on the case. Both companies charged that they had signed the code under duress because of the penalties levied on non-compliers. Judge Schoonmaker, in federal district court at Pittsburgh, Pa., denied the government's motion in the case of the Pittsburgh Coal Co. and five other companies asking the court to modify the preliminary injunction order to the extent of requiring the plaintiffs to deposit with the court the 1½ per cent tax pending a decision in the suit. The court declared that "we granted the preliminary injunctions in these cases because serious doubt existed in our mind as to the constitutionality of the Bituminous Coal Code."



E. P. Humphrey

Personal Notes

J. M. CLARK, JR., mining engineer, Koppers Coal & Transportation Co., has been promoted to division engineer at Mt. Hope, W. Va., succeeding M. A. EVANS. Mr. Evans has been transferred to the Sonman Shaft Coal Co. mines, near Portage, Pa., the management of which was recently taken over by the Koppers company.

JOHN C. COSGROVE, president, West Virginia Coal & Coke Corporation, has been appointed as representative of the National Coal Association on the mining standardization correlating committee of the American Standards Association for the term ending Dec. 31, 1936.

R. J. COTTS, formerly purchasing agent of the Hitchman Coal & Coke Co., operating in the Panhandle field of West Virginia, has been elected president of the company. He succeeds John W. Sands. JOHN H. KOCH has retired from the vice-presidency, but no successor has been named. LOUIS YEAGER has been made secretary.

HOWARD N. EAVENSON, president, Clover Splint Coal Co., has been named a director of Bituminous Coal Research, Inc., to fill the vacancy caused by the resignation of CHARLES G. BERWIND, vice-president, Berwind-White Coal Mining Co., who withdrew because of the pressure of other duties. Mr. Eavenson, who has been active in the affairs of the research organization since its inception, has been serving as chairman of the committee on research program.

E. P. HUMPHREY has resigned as superintendent of preparation and stripping for the Lehigh Navigation Coal Co. to take the position of assistant to the president for the following companies: Stonega Coke & Coal Co., Virginia Coal & Iron Co., Westmoreland Coal Co. and Westmoreland, Inc., with headquarters in Philadelphia, Pa. He assumed his new post on Feb. 24. Graduated from Lehigh University in 1915, Mr. Humphrey was connected with the Lehigh Valley Coal Co. before becoming associated with the Wentz interests, to whom he now returns. He also has been associated with the Hazle Brook and Jeddo-Highland coal companies.

J. E. MARTIN, manager, stoker division, Link-Belt Co., was reelected president of the Midwest Stoker Association at the annual meeting, in Chicago. Other officers named are: vice-president, W. J. O'NEIL, sales manager, Chicago branch, Iron Fireman Mfg. Co.; secretary-treasurer, H. L. BILSBOROUGH sales manager, stoker division, Fairbanks, Morse & Co.

GEORGE H. MORSE, vice-president and general manager, Union Collieries Co., was reelected president of the Coal Operators' Association of the Thick Freeport Seam of Pennsylvania at its annual meeting on Jan. 29. Other officers reelected are: vice-president, W. P. VANCE, general superintendent, Butler Consolidated Coal Co.; secretary, C. W. GIBBS, general manager, Harwick Coal & Coke Co.; treasurer, GEORGE C. TREVORROW, assistant to general manager, Harwick Coal & Coke Co.

JAMES H. PIERCE was elected president of the Scranton Coal Co., Scranton, Pa., on Jan. 28, succeeding James L. Cooney. W. F. MATHIESON, secretary-treasurer, retained that office and also became vice-president.

F. E. RILEY, who had been connected with the Pittsburgh (Pa.) station of the U. S. Bureau of Mines, has been transferred to the Birmingham (Ala.) branch as junior safety instructor.

M. M. SOULE has been elected vice-president of the United Electric Coal Cos. Other officers named are: treasurer and purchasing agent, JOHN V. NORTON, who succeeds J. G. MANLEY, resigned; assistant treasurer, E. M. STIGLIC; engineer in charge of operations, M. M. MOSER. LOUIS WARE, president of the company, has been elected president of the Coal Sales Corporation, a subsidiary of United Electric, succeeding Fred S. Martin, resigned; J. M. MORRIS, secretary and assistant treasurer; and Mr. Stiglic, assistant secretary. Mr. Soule is vice-president of the latter company.

Obituary Notes

ERNEST A. GREENWOOD, 76, treasurer of the Utah Fuel Co., Salt Lake City, Utah, died of a heart attack Feb. 4 in the office of a financial institution a few blocks from his firm's headquarters. Born in Illinois, Mr. Greenwood went west and entered the service of the Western Union Telegraph Co., later taking up railroading. In 1907 he became cashier and assistant treasurer of the Utah Fuel Co., being promoted to treasurer fourteen years ago.

ALEXANDER M. DUDLEY, 58, general coal

freight agent of the Chesapeake & Ohio Ry., died Feb. 9 at his home in Richmond, Va., after an illness of several weeks. He entered the service of the C. & O. at St. Louis in 1904, becoming contracting agent for the road in 1910 at St. Joseph. Seven years later he joined the traffic department at Cincinnati, becoming general coal freight agent at Richmond in 1923.

WILLIAM JAMES, 51, formerly superintendent of preparation with the Lehigh & Wilkes-Barre Coal Co. and for the last four years breaker boss at the Wanamie colliery of the Glen Alden Coal Co., died Feb. 17 at his home in Wilkes-Barre, Pa., from a heart ailment.

LAFAYETTE TUCK, formerly general superintendent of the Cosgrove-Meehan Coal Co. of Pennsylvania and later general superintendent of the West Virginia Coal & Coke Corporation, died Jan. 31 at his home in Pennsylvania.

RUFUS J. IRELAND, 61, president of the Owl Creek Coal Co., Gebo, Wyo., died Feb. 21 at his home in Amityville, L. I., of a heart attack.

Governor Earle Refuses Help To Curb Bootlegging

Governor Earle of Pennsylvania has flatly refused to comply with the demand of anthracite operators for State assistance in stamping out "bootleg" mining in the lower anthracite region. Fourteen producers headed by Charles F. Huber, president, Anthracite Institute, had a conference on Feb. 4, with the Governor and State Attorney General Charles J. Margiotti in an effort to obtain help in putting a stop to unauthorized mining on the properties of the mining companies. In declining to interfere, the Governor said that State police would not be sent into the region affected to arrest outlaw miners until local authorities certified that the situation was out of hand.

According to a statement by Mr. Huber, the operators were amazed at the position taken by Governor Earle, in view of the clear-cut provisions of the Constitution and the laws of the State. As long as the stealing of coal continues, Mr. Huber added, it will result in increasing unemployment of legitimate labor.

Participating in the conference, besides the Governor, the Attorney General and Mr. Huber, were Michael J. Hartneady, Secretary of Mines, and the following operators: L. R. Close, president, Lehigh Valley Coal Sales Co.; Charles Dorrance, president, Penn Anthracite Mining Co.; T. M. Dodson, vice-president, Weston Dodson & Co.; C. A. Gibbons, general manager, Susquehanna Collieries Co.; John Gilbert, president, Madeira, Hill & Co.; F. W. Leamy, senior vice-president, Hudson Coal Co.; T. D. Lewis, general superintendent, Lehigh Navigation Coal Co; Louis C. Madeira, 3d, executive director, Anthracite Institute; Donald Markle, president, Jeddo-Highland Coal Co.; James H. Pierce, president, Scranton Coal Co.; Frank Passarelli, president, Pompey Coal Co.; H. M. Smyth, president, St. Clair Coal Co.; Nat. D. Stevens, president, Stevens Coal Co., and R. E. Taggart, president, Philadelphia & Reading Coal & Iron Co.

Some of the operators have indicated that they will follow Governor Earle's suggestion that they ask county sheriffs to halt the operations of outlaw miners. Oscar F. Ostby, president, Independent Anthracite Coals, Inc., declared Feb. 5, "if the sheriffs say they can do nothing, we will again throw the question back in his [the Governor's] lap, call his bluff, and see what he will do."

A single organization, known as the Independent Anthracite Miners' Association of Schuylkill County, was formed on Feb. 9 at Minersville, to take the place of the former six-district set-up. In addition to electing officers, the delegates named a three-men grievance board, which was directed to call on Sheriff Thomas Evans and the County Commissioners to learn their attitude toward "bootleg" mining and what action, if any, they will take regarding it. The new organization is divided into three subdivisions with Mahanoy City as the center of one, Pottsville of another, and Minersville of the third. These officers were elected: president, George Layman, Mahanoy City; vice-president, Alex Strincosky, Llewellyn; secretary, Carl Heinman, Minersville; treasurer, Peter Paul, Llewellyn; organizer, George Lasco, Brandonville.

ANTHRACITE NEGOTIATIONS START IN NEW YORK

Negotiations for a new anthracite wage agreement to replace the present 5½-year contract expiring March 31 got under way Feb. 24 at the Engineering Societies Building, New York City, in the first of a series of daily afternoon meetings. W. W. Inglis, president, Glen Alden Coal Co., was elected chairman of the joint conference of operator and union representatives, and John Boylan, United Mine Workers, was chosen secretary.

Opening the negotiations, the union delegation, headed by John L. Lewis, presented the demands adopted at the Washington tri-district convention Dec. 6, 1935, including: a six-hour day and a five-day week; "a substantial increase in wage scales"; equalization of working time to check bootlegging; complete check-off of union dues; abolition of special or individual contract systems; provision that not less than minimum rates be paid for occupations where lower rates exist; safeguarding regulations for the control of indiscriminate stripping or strip mining; establishment of a uniform rock scale based on Panther Valley rates and discontinuance of the practice of letting contracts for rock work; inclusion of all workers in the industry and its related processes in the general agreement; a two-year term for the new agreement, etc.

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Power Confab Includes Coal

A coal session will be a feature of the Midwest Power Engineering Conference, to be held April 21-24 at Chicago in conjunction with the Midwest Engineering and Power Exposition. Joseph Harrington, Chicago engineer, will present a paper on "Simplification of Coal Sizing," and other topics will include "Use Value," "Equipment," "Simplification." "Fuel Economy" and "Simplification of Controls." Conference sessions will be held each morning in the Palmer House and in the afternoon at the International Amphitheater, where the exposition also will be held.

N.C.A. Opposes Extension Of Emergency Rates

Dismissal of the petition of certain Class 1 railroads for indefinite extension of existing emergency freight rate surcharges (Ex Parte 115) at least in so far as it affects shipments of coal and coke is asked in a motion filed with the Interstate Commerce Commission Feb. 5 by the National Coal Association. The association's brief contends that the plea of the railroads filed Jan. 24 is in reality an effort to obtain a reversal of the Commission's original decision denying the carriers' original petition for a permanent rate increase. It is further alleged that the present proposal of the railroads has "already been considered by the Commission and denied in principle"; that the Commission is without authority on the present proceedings to find the emergency surcharges "just and reasonable as permanent additions to the rates," and that the record in the present case is "conclusive that the emergency surcharges are unjust and unreasonable as permanent additions to the rates." The Commerce Commission has set March 4 as the date for a hearing, before Commissioner Aitchison, of the railroads' petition.

"The record in this proceeding," says the N. C. A. brief, "shows that the high level of rates on coal which existed even before the addition of the emergency surcharges was causing a loss of coal traffic to the rail lines (1) by reason of the substitution of other sources of energy such as oil, electric power and gas which require much less rail transportation, and (2) by diverting coal traffic to other forms of transportation, especially trucks. Such changes, particularly the first, are accomplished gradually. With a temporary increase in rates, such as authorized, changes to other forms of power may be postponed. . . . But should the increased cost become permanent, as now proposed, the losses of coal and coke traffic to the rail carriers will be accelerated.

"The record also proved beyond question that such increases, if any, in revenue as might be yielded by the increased rates on coal would inure to the benefit of those rail lines which were least in need of financial assistance. The principal coal-carrying roads are included in the class of rail carriers which may properly be designated as prosperous.

"Those railroads which individually are most in need of assistance not only fail to benefit from any increases in coal rates but are actually injured thereby because of the fact that many of them must purchase coal from mines of off-line roads and pay the additional surcharge or at least a part of it."

Although the carriers' petition listed a number of roads that had gone into receivership recently, none of those mentioned is dependent primarily upon coal for revenue. The operators' association also emphasizes that the petition for continuance of emergency rates was not signed by these coal carriers: Cambria & Indiana, Montour, Pittsburgh & West Virginia,

Virginian, Wheeling & Lake Erie, and Detroit & Mackinac.

The existing emergency freight surcharges, which, as respects coal, average 12c. per ton, expire by limitation on June 30, unless otherwise ordered by the Commission.

Roberts & Schaefer Services Continue as in Past

No change in the scope of the activities of the Roberts & Schaefer Co., Wrigley Building, Chicago, are contemplated pending proceedings under the provisions of Sec. 77(b) of the federal bankruptcy act, according to an announcement by Edward E. Barrett, president of the company. The legal steps taken, says Mr. Barrett, were necessary "to protect ourselves and our creditors against a judgment rendered against us in West Virginia for alleged infringement in connection with a process for the air cleaning of coal which we were using in 1926," and the order of the court of Jan. 17, made permanent Feb. 10, specifically provides for carrying on the operations of the company without change.

RFC Loan to Kingston Coal Co.

A loan of $550,000 to the Kingston Coal Co., anthracite producer, of Kingston, Pa., was approved Feb. 14 by the Reconstruction Finance Corporation. Of this sum, $237,000 will be obtainable the first week in March to pay employees for back wages and compensation.

Idle Mines Resume

G. B. mine of the Klondike Fuel Co., at Masontown, Fayette Co., Pa., which had been closed since Sept. 20, 1935, resumed operations on Feb. 6. The mine, which is owned by Cinci Brothers, will operate on a schedule of three to four days a week, employing about 120 men. The operation has a capacity of 800 tons per day.

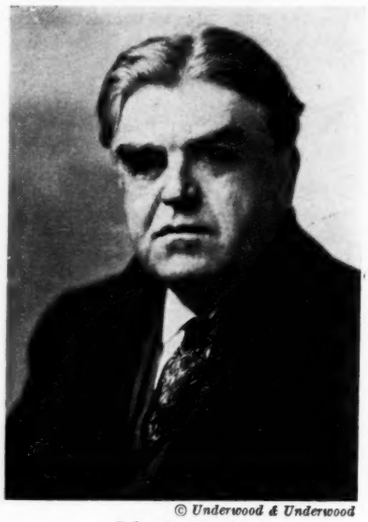
Exeter colliery, Wilkes-Barre, Pa., leased by the Payne Coal Co., started work on Feb. 10 after being idle for several months. The colliery formerly was operated by the Lehigh Valley Coal Co.

Stearns Strike Settled

Operations were resumed Jan. 27 at the mines of the Stearns Coal & Lumber Co., in McCreary County, Kentucky, after a shutdown lasting four months due to a strike. The employees, demanding that the company sign a contract providing shorter hours and increased pay, walked out when their demands were refused. A compromise was reached in federal court at Lexington, Ky., on Jan. 22, after the company had brought suit to compel the strikers to vacate company-owned houses. The company agreed to sign a new wage-hour contract next year. Approximately one thousand men returned to work.

Mines 95 Per Cent Union, Convention Told; Tetlow Warns of Crisis

WHOLE-HEARTED indorsement of President Roosevelt and the "new deal," evidenced by enunciation of a purpose to support his candidacy for reelection was a highlight of the 34th constitutional convention of the United Mine Workers, held at Washington, D. C., Jan. 28-Feb. 8, with 1,716 delegates present. Achievements in increased wages and membership since the preceding biennial meeting were declared to be the greatest in the history of the organization, the coal industry, according to John L. Lewis, international president, being more completely organized than ever before, collective bargaining more universally accepted, membership of the union greater than ever, the financial resources of the union at its peak, and "the potential strength of the organization transcending the imagination of the organized labor movement of the country and the public at large."



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John L. Lewis

Not only did the delegates unanimously indorse the Roosevelt administration but they authorized the executive board to contribute to the campaign to reelect the President, as well as to solicit contributions from several thousand local unions. This is the furthest any labor union has gone in participating in a national political campaign since the executive council of the American Federation of Labor indorsed the Presidential candidacy of the late Senator La Follette in 1924. Forty-five resolutions urging support of President Roosevelt were presented.

Mr. Lewis explained that the convention was not being asked to indorse the Democratic Party as such, but that it "was rising to meet a crisis in the economic and political affairs of the nation." He suggested that the American Federation of Labor take similar action, and predicted that if this were done, "then, for all practical purposes, the next election for President in this country will be assured as to its results."

Hailing the Bituminous Coal Conservation Act of 1935 as "the first constructive act in history enacted by a government in the interests of its people for the alleviation of the depression, the economic distress and the hopeless, tragic condition of miners in the benighted coal industry," Mr. Lewis called attention to the belief expressed in some quarters that the Supreme Court of the United States would declare the act unconstitutional. According to Mr. Lewis, the statute "would in effect redound more greatly to the interest of the owners, investors and operators than the mine workers," and the likelihood that it would be invalidated made it necessary for the miners to prepare themselves "to be cast from this shelter and thrown again into the storm that rages outside and be prepared again to endure their previous miseries and sufferings."

In the event that the high court declared the coal stabilization act invalid, Senator Guffey, sponsor of the bill, promised that the battle would continue. In an address at the second day's session, the Pennsylvania Senator said: "If there exists any phase of our economic and social life which deserves and requires regulation on a nation-wide basis, no better example could be found than the bituminous coal industry as it existed in 1935. . . . Should the court knock out this act which contains such great humanitarian principles in behalf of labor, I pledge myself to a continuation of the efforts of your leaders, and I stand ready to sponsor further legislation which may accomplish the results which they and I so greatly desire. I am in this fight to a finish and will consider it ended only after you and I have obtained that which we want and that to which the members of your organization are entitled."

Chairman Hosford of the National Bituminous Coal Commission expressed the "firm hope and belief that the Supreme Court will hold the Coal Conservation Act as constitutional." He warned his hearers, however, that if the law was sustained, the industry's difficulties would not be ended; the law must be enforced. A real responsibility rests upon the United Mine Workers, he declared, "to assist this commission in making the law effective in every coal-producing State in the nation." The commission, he pointed out, is an impartial one, whose duty it is to safeguard the rights of mine labor, protect the producers, and give full consideration to the interests of coal consumers.

Percy Tetlow, member of the coal commission and former president of District 6 (Ohio), U.M.W., deplored the hampering effect of restraining orders granted by the courts against administration of the Guffey Act. Although these restraining orders represent possibly only 15 per cent of the country's tonnage, he said, they prevent the exercise of the law and its fulfillment. Under cover of court orders, Commissioner Tetlow charged, coal is being marketed in some districts at 30 to 40c. below the cost of production, and it is only a question of time until a crisis will arise.

"If the Coal Conservation Act is declared invalid by the Supreme Court, and if the marketing of this coal cannot be

regulated by the federal government," he declared, "then I say to you that it will not be three months from this date until this industry is facing a crisis. You will be faced with sweeping wage reductions, because the present prices of coal will not support the present wage levels. There is no one who can save this industry from disorder and disaster if the courts strike down this act but you men who work in the coal mines. There is no other power to prevent it from going back into the jungle where it was prior to the passage of NIRA."

Emphasizing pitfalls in the path of the Guffey act, Representative Fred Vinson, of Kentucky, called attention to the effort made in Congress in January to kill appropriations for the coal act in the Deficiency bill and later in the Appropriation bill. He also stressed the need for cooperation if the miners' organization hoped to maintain the progress it had made. Senator M. M. Neely, of West Virginia, commended the union officials for their accomplishments in the cause of organization and called attention to the influence of President Roosevelt in making such gains possible.

Decries Gospel of Despair

Enactment of legislation by Congress which set up the right of workmen to organize and abolished the "right" of employers to prevent it was hailed by J. Warren Madden, chairman of the National Labor Relations Board, as making for peace and order in industry. It would curb armed marches, insurrection, and the need for tent colonies, he implied. Those who said the law was unconstitutional, he added, preached a gospel of despair.

Brief addresses also were made by Governor Earle of Pennsylvania, Senator Sherman B. Minton, Representatives J. Buel Snyder and Patrick J. Boland. Secretary of Labor Perkins and Miss Josephine Roche, Assistant Secretary of the Treasury.

A proposal to curb the power of the Supreme Court to invalidate legislation unless "unconstitutional beyond a reasonable doubt," submitted in 24 resolutions, met with unanimous approval. The entire delegation voted to support legislation requiring greater unanimity on the part of the court in exercising veto powers and expressed itself in favor of amending the Constitution "to permit Congress to legislate with respect to matters of national interest beyond effective State control."

The rift between President Lewis and William Green, president, American Federation of Labor, caused by the miners' leader's championing of organization by industries rather than by crafts almost reached a definite break. The convention unanimously indorsed the policy of Mr. Lewis and granted authority to the executive board to withhold $48,000 in annual dues to the federation if, in its discretion, the board saw fit to do so. Even a fervid outburst of oratory from Mr. Green to the effect that the federation would not "tolerate" a challenge of its supremacy failed to move the convention from its stand, all but one of the delegates present voting to defy Mr. Green's ultimatum.

As a reply to the recent suggestion of the A. F. of L. executive council that the eight unions forming the committee for industrial organization disband, the miners' convention instructed Mr. Lewis, chairman of the eight-union group, to deliver a series of radio speeches on a nation-wide hook-up to stress the need for industrial unionism in the mass-production industries. In answer to a question from the floor, Mr. Lewis said that withdrawal from the A. F. of L. "would depend on conditions" and that the executive board would determine the policy as conditions might arise. For the present, he added, "the status quo remains."

Open Union to Coal-Plant Men

Membership in the U.M.W. was opened to employees "in and around coal-processing plants" with the unanimous adoption of an amendment to the constitution. The change presents a prospect of additions to the union from among numerous unorganized men in byproduct and gas and chemical plants. It also opens an additional point of controversy with the American Federation of Labor. The amendment—Art. XIV, Sec. 1—now reads:

"Local unions shall be composed of ten or more workmen, skilled and unskilled, working in or around coal mines, coal washers, coal-processing plants, or coke ovens, but seven members shall be a quorum for a local union."

Discussion of autonomy for several districts now under direct charge of the international organization, concerning which question 218 resolutions were received, waxed so warm that a fist fight broke out between two delegates. A roll call, however, showed that the recommendation of the executive board that the matter be left in its hands was sustained by a vote of 3,148 to 1,134.

The union had a cash balance of $2,298,021.42 as of Dec. 1, 1935, according to the joint report of the international officers. This compares with $311,865.20 reported at the previous convention as of Dec. 1, 1933. The report also showed that 95 per cent of workers in the anthracite and bituminous industries are members of the U.M.W., and several resolutions urging intensive efforts toward organization of the remaining 5 per cent were unanimously adopted. Harlan County, Kentucky, received special mention as a dark spot in efforts at unionization, but Representative A. J. May, of that State, disclosed that a bill backed by Governor Chandler is pending in the State Assembly having for its object the preservation of civil liberty.

Wage scale demands of anthracite workers (*Coal Age*, December, 1935, p. 549) were indorsed by an overwhelming majority. In reference to numerous resolutions affecting wages in bituminous fields, the resolutions committee recommended that "all matters pertaining to basic wage rates, hours of labor, differentials, etc., be referred to the wage scale committee" of the international union, and the scale committee be empowered, "through the medium of a national, Appalachian, or such other wage-scale conference as may be designated by the national policy committee, to negotiate the best contract obtainable." It was further recommended that, "in order to broaden the scope of the joint wage-scale conference, an effort be made by the officers of the international union to secure a national wage-scale meeting." After considerable discussion, the recommendations were adopted with only eight dissenting votes. Washington was selected as the scene of the 1938 convention.

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U.M.W. Objectives

BASIC proposals contained in the international officers' report and approved by the biennial convention of the United Mine Workers, held at Washington, D. C., Jan 28–Feb. 8, include:

Six-hour work day and five-day week.

Support of anthracite miners' wage demands in agreement to replace that expiring April 1.

Continuance of Bituminous Coal Stabilization Act and Wagner-Connery Labor Relations Act,

Curb on power of Supreme Court to invalidate legislation unless unconstitutional beyond a reasonable doubt.

Support of the administration's social security legislation.

Protection of constitutional rights of free speech and a free press.

Support of an adequate low-cost federal housing program.

Industrial Notes

The St. Louis (Mo.) district sales office of LINK-BELT Co. has been moved to larger quarters in the Louderman Building, 317 North Eleventh St.

GEORGE DANDROW has been appointed district manager of the power products and industrial department of the Johns-Manville Sales Corporation in New York, with offices at 22 East 40th St.

G. L. SMITH has been promoted to assistant sales manager of the Republic Rubber Co., Youngstown, Ohio, after thirteen years' service with the company. R. H. SONNEBORN has been appointed special sales representative of the tubular division.

M. A. CARPENTER, formerly advertising manager and later in charge of sales promotion for the Falk Corporation, Milwaukee, Wis., has been appointed sales manager, succeeding L. A. GRAHAM, resigned.

TIMKEN ROLLER BEARING CO., announces the appointment of S. C. PARTRIDGE as assistant general manager of the industrial division, with headquarters in Canton, Ohio. He joined the organization in 1925. F. B. YATES has been promoted to the position of manager of the New York office, in charge of industrial sales. R. W. POWERS has been transferred from the engineering department at Canton to the New York office as assistant to Mr. Yates.

R. E. GERDETZ has been appointed a sales representative for the Joy Manufacturing Co., Franklin, Pa.

CUTLER-HAMMER, INC., Milwaukee, Wis., announces the appointment of R. J. ECKSTEIN as manager of the firm's Cleveland (Ohio) office, at 1405 East Sixth St.

WHAT'S NEW

In Coal-Mining Equipment

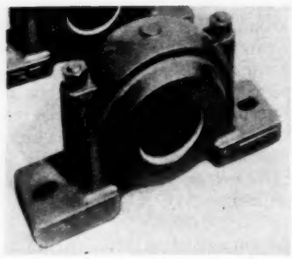
STRIP-PIT DRILL

Speed, safety, low first cost and low operating cost are claimed for the new electric strip-pit drill of the Hardsocg Mfg. Co., Ottumwa, Iowa. The drill, the company points out, is light in weight and easily handled by one man, and requires only a trailing cable to make it ready for service. Augers are of the conveyor type which clean the hole, and are fitted with cutter heads with inexpensive renewable teeth which, when coated with hard-surfacing

material, will cut through sulphur and similar hard materials. The 3-hp. motor driving the unit is dust- and weather-proof, and can be furnished for either 220 or 440 volts, a.c. Starting and stopping of the motor are controlled by a Westinghouse dust- and weather-proof switch with pushbutton control.

PILLOW BLOCK

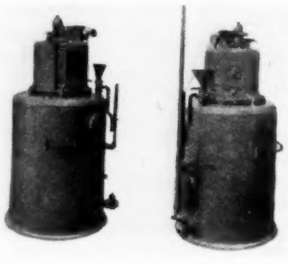
The SA-Type pillow block has been added to the line of transmission devices manufactured by SKF Industries, Inc., Philadelphia, Pa. Used in conjunction is the SKF spherical roller bearing said by the company to have established its value already in hard service. The SA pillow block features a split construction to reduce the number of parts and, with the spherical roller bearing, has inherent rolling self-alignment without imposing extraneous loads due to set-up inaccuracies or shaft deflections. It is designed with cross and transverse ribbing to assure the greatest strength with the least weight and minimum warping. Felt sealing rings shield the bearings against dirt and other injurious matter. When extreme dirt conditions are encountered, flingers can be used. To install, the lower half is set in place and bolted, the bearing mounted on the shaft and properly located, and the upper half then bolted on.



ACETYLENE GENERATOR

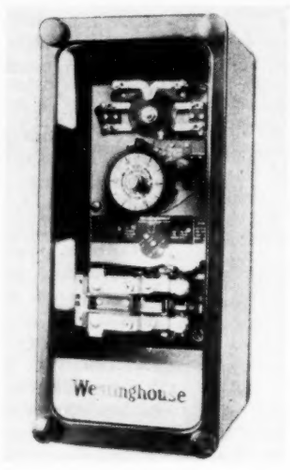
Linde Air Products Co., New York City, offers a new small-sized medium-pressure acetylene generator for portable or stationary service, designated as Oxweld Type MP-6. Carbide capacity is 50 lb., with a double rating of 100 cu.ft. of acetylene per hour. Carbide feed can be controlled for any desired pressure up to 14 lb. per square inch. There is practically no exposed piping, the company points out, and such operating mechanisms as the feed control, carbide hopper, hydraulic back-pressure valve and filter are all assembled within the dome-shaped top, which may be tilted back when access to the interior is necessary. Automatic controls, it is stated, make the unit unusually safe. It has been tested and accepted by the Underwriters' Laboratories at the double rating for generating capacity, and has been listed for both stationary and portable service.

Left, generator for portable service; right, equipped for stationary service



ELECTRICAL AIDS

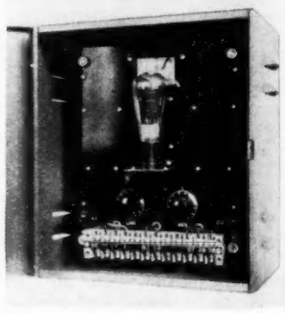
A new motor-operated timing recloser featuring an integrating lockout device for automatically reclosing a.c. or d.c. electrically operated breakers on alternating-current systems is offered by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Features of the new RC recloser include initial immediate reclosure, anti-pumping and a cumulative limit switch. The recloser is mounted in a metal case 5½ in. wide x 12 in. long, with glass window and rear-connected terminals. It is adaptable to mounting on any of the usual panel materials, and all electrical contacts are silver-to-silver with ample current-carrying capacity.



Small, sturdy headlights for use on haulage and gathering locomotives, surface equipment, etc., have been announced by Westinghouse. Designed, according to the company, to withstand the impact of falling coal or rock, they are built of one-piece semi-steel for severe operating conditions.

The permissible type is explosion-tested for use in gaseous mines, subject to certified approval by the U. S. Bureau of Mines. It differs from the standard type only in the door frame and wiring. A cable packing gland and hose clamp permitting inclosure of wiring in a rubber hose are located in the center of the back of the mounting, either on the right or left of the locomotive. A standard 56- or 94-watt lamp with a rating of 105-130 volts is used in a medium-base multiple lamp socket equipped with bronze lamp grips and mounted inside the body on a shock-absorbing support. The lens is ½-in. heat-resisting glass, and the reflector is spun brass with chromium-plated reflecting surface.

Angle switching equipment for controlling large synchronous-motor-driven reciprocating pumps and compressors to prevent the compression strokes on different units occurring in uni-



son is another Westinghouse development. Employing an electronic tube, the device is said to reduce the magnitude of current pulsations effectively where two or more drives are used.

Westinghouse also offers a new line of light-weight, compact portable volt-ohmeters and test units for general test-

ing and laboratory work. Equipped with a new sturdy d'Arsonval movement and selector switches for range selection, the units are said to simplify testing of circuit resistance, continuity and insulation. Several types are available, including: simple ohmmeters, volt-ohmmeters, d.c. test units and the more elaborate multi-scale a.c. and d.c. test units. Accuracy on volts and milliamperes is within 2 per cent for d.c. and 5 per cent for a.c. Weight is approximately 2 lb.; case dimensions, 7x4x3¼ in.

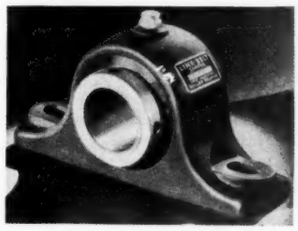
TEMPERATURE INDICATOR

Ideal Commutator Dresser Co., 1831 Park Ave., Sycamore, Ill., has developed the Ideal "Tel-Temp" indicator as an inexpensive substitute for the built-in temperature recorders employed on large machines. The indicator is offered for quick and accurate determination of temperatures in both open and closed motors, bearings, air compressors, centrifugal pumps, busbars and similar equipment. The bimetallic principle is employed and the unit consists of a dial plate mounted in a dustproof aluminum case protected by a non-breakable crystal and chromium-plated cap. The dial is graduated for temperatures from 0 to 100 deg. C., and green, orange and red zones back of the scale indicate safe, caution and danger zones.

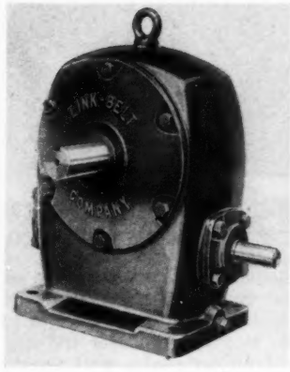
The indicator may be permanently mounted on the machine, or each indicating point may be fitted with a screw base and one indicator carried from place to place and attached as desired to ascertain the temperature. The case of the indicator is fitted with a flexible rubber ring which fits tightly against the machine and thus prevents draughts and outside temperatures from affecting the readings. For installation on open motors, a special plastic-ring jacket is supplied to shield the unit from cross currents of air.

BEARING UNITS; REDUCERS

Link-Belt Co., Chicago, announces the development of a new line of bearing units known as the Link-Belt-Shafer self-aligning roller bearings, "Series 400," in all popular sizes. Shafer self-aligning double-row roller bearings are used in Link-Belt mountings, declared to be an excellent combination for general service. These units are available for pillow blocks, flange bearings, hangers and take-up. Advantages of the new combination are summarized by the company as follows: inherent self-alignment and ability to carry radial, thrust and combined radial and thrust loads.



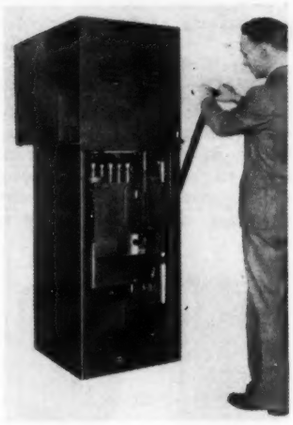
Link-Belt Co., Philadelphia, Pa., offers a new line of cut-tooth worm-gear speed reducers for which it notes simplicity, compactness, accessible construction and adaptability to great flexibility in driving arrangements. The new reducers are available in a wide range of ratios and capacities, single or double reduction, and in horizontal and vertical types, all provided with precision tapered roller bearings and automatic lubrication within dustproof gray-iron housings. The output shaft can be located above or below the worm shaft, and a feature of the double-reduction unit, the company points out, is the unit attachment of the primary reduction unit to the side of the final reduction housing.



ELECTRICAL CONTROLS

"Streamlined" switchboards are now offered by the General Electric Co., Schenectady, N. Y., with devices built in, instead of hung on, the faces of the panels. Steel is used in the new units, and the instruments are recessed so that they project about 1 in. from the front of the panel. Clean lines, attractiveness, modern construction and easy installation are claimed for the new boards, and the construction is applied not only to vertical boards but to benchboards, cubicle doors, metal-clad front inclosures and swinging brackets. Air circuit breakers used are of the dead-front type with current-carrying parts inclosed. Other devices have been redesigned for semi-flush mounting.

Metal-clad switchgear (Type MI-9) has been extended to light-duty service for a wide range of applications, the company announces. Advantages stressed are ease of installation, economy, safety, and reliability and continuity of service. The new Type FK-42 oil circuit breaker is employed in either of two ratings: 600 amp. at 5,000 volts or 800 amp. at 2,500 volts, both with an interrupting rating of 25,000 kva. The breakers, which are removable, may be manually or electrically operated. To remove a breaker, it is lowered by the elevating mechanism and then withdrawn from its housing.

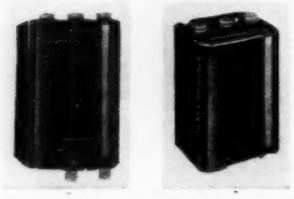


General Electric also offers light-duty outdoor hook-operated disconnecting switches FD-102 (vertical mounting) and FD-103 (underhung mounting). These are available in 7,500S- and 15,000S-volt, 200- and 400-amp. ratings. The galvanized-channel base is provided with slots to make it suitable for pole-top crossarms. Insulators are NEMA substandard cemented cap and pin construction with 2-in. bolt-circle cap and pin. Tongue construction is employed, with double-type blade fabricated from hard-drawn copper. Simple, effective blade latch assures latching in closed position. Clamp-type terminals are used, eliminating soldered connections.

Four new conduit grounding items—one box for fixture mounting and three grounding fittings which can be quickly installed and are said to afford secure connections—are further General Electric offerings. The fixture box (Type SP-5200B) is said to provide a simple and effective method of grounding and to make possible firm mechanical and electrical connection between box and armor. Two of the fittings (Types SP-825 and 826, intended for ½- and ¾-in. conduit, respectively) are equipped with a reversible shackle that fits three sizes of water pipe, a U-bolt with wide flat strap being used to make the connection. This is said to afford high bonding pressure without pipe injury and allow the conduit hub to meet the pipe at any angle. The Type SP-828 fitting has a connection which firmly grips and holds the armored cable. Both soldered and solderless connections may be made.

BATTERY

Sturges Battery Corporation, New York City, now offers the Sturges "Multipower" lantern battery, which it describes as "a storage battery as dry as any dry battery." In addition to the non-spill feature, the company declares that the new batteries, some of which are now being used with cap lamps in mines, are guaranteed to replace in use and service cost at least 100 dry batteries of equivalent size,

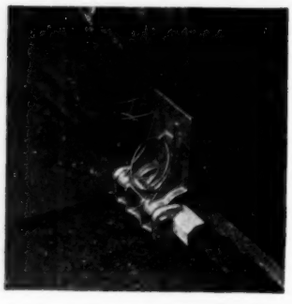


Battery with and without adapter

and for 100 cycles of charge and discharge or for one year if recharged in accordance with instructions. Specifications are: height, 4 in.; length, 2⅜ in.; width, 2¼ in.; volts, 6; current, 3 amp.-hr. at 10-hour rate; weight, 30 oz. An adapter is supplied for use with the battery to make accurate contact in all electric lanterns now in use.

CAR STOPS; DERAIL

Three new safeguards against injuries from runaway cars are offered by the Portable Lamp & Equipment Co., Pittsburgh, Pa. These are: a mine-car stop, a mine-car skid and a mine-car derailer. All three devices, the

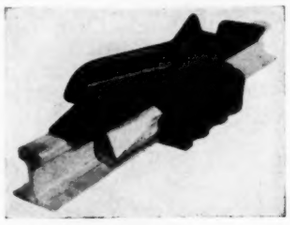


company states, are made of high-tensile-strength malleable iron and can be quickly and easily installed. To reduce cost of installation and facilitate handling, the units are designed with interchangeable bases. All three are locked to the track rail by wedges, which can be cut from cap pieces.

The mine-car stop is designed so that it can be placed in operating position by lifting the

ring, which also is employed to unlock the stop prior to swinging it clear to permit passage of equipment. The stop, it is stated, can be swung clear even with the load against it. Height of the stop is 7 in. over the rail, and it is designed to work against the wheels of high cars and the bumpers of low cars.

Designed to act as an external brake, the mine-car skid can be attached to the rail where a derail normally would be placed. The skid consists of the base and a detachable sliding member, which is detached from the base when struck by a car and slides down the track under the wheel. Six sizes, in rights and lefts, are available. When not on guard, the skid can be swung off the rail to allow passage of equipment. It is designed so that it can be used with the derailer described below, slowing down the speed of the car and thereby reducing the damaging

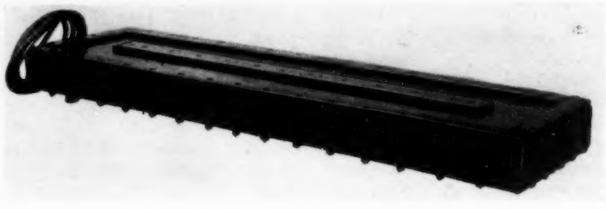


effect of the derailment. The skids also can be used in trips on downgrades to increase braking effect.

Like the other two devices, the new derailer also can be swung out of the way when desired. It is a two-way unit designed to derail a runaway from either direction.

MAGNET

Central Electric Repair Co., Fairmont, W. Va., offers a new tramp-iron-removal magnet for installation in main and auxiliary chutes and shaker screens, on the ends of loading booms, etc., or, it announces, anywhere where coal is being conveyed.



Design, it is stated, is arranged so that the magnets can be made a part of conveying equipment at very little cost for installation. To date, the company offers lengths of 60 and 81 in., each 16½ in. wide and 4½ in. deep. Current input is respectively 1½ and 2 kw., either 125 or 250 volts, d.c., as required.

Weight of the 60-in. magnet is approximately 850 lb.; 81 in., approximately 1,400 lb. Construction details include: double pole face on magnets for high efficiency and easy removal of tramp iron with minimum current consumption; single coil made of continuous wire, specially impregnated and insulated in a pure mica cell, which can be removed without danger of the collapsing of the wire as a result of the impregnating compound and heat-treating methods employed; moisture- and weatherproof construction growing out of assembly of the preformed, treated and insulated coil with a waterproof compound.

KVA. METER

Lower cost, greater strength and higher accuracy are features of the new graphic kva. meter offered by the Esterline-Angus Co., Indianapolis, Ind. The direct measure of kilovolt-amperes is accomplished by interposing between the line and the instrument a phase-shifting network, which supplies to the potential coils of the meter a voltage which lags behind the line potential by an amount equal to the lag of line current behind line potential. Current and potential within the instrument being in phase, the instrument records kilovolt-amperes directly. To adapt the instruments to circuits of different power factors, the network is provided with three taps—0.54 to 0.82, 0.68 to 0.90 and 0.75 to 0.94 power factor.

The network is designed to permit use of the instrument on either three-phase three-wire or three-phase four-wire circuits and interchangeably on 110- or 220-volt circuits. It will stand a breakdown voltage of 2,500 for one minute, the company states, and the meter alone, without the network, may be used to record kilowatts in a.c. circuits.

Meters are available in four types of cases: flush switchboard, front switchboard, wall mounting and portable, and all but the portable types can be furnished in twin cases in combination with any of the various graphic meters of the company. Any of the five standard chart drives of the company can be supplied. Charts are 6 in. wide and 90 ft. long, uniformly divided and printed in two colors.

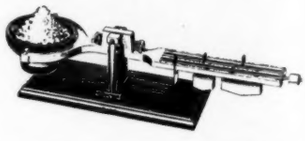
STRAIN CLAMP

Ohio Brass Co., Mansfield, Ohio, offers a new line of "Hi-Lite" strain clamps for which high strength and light weight are claimed. These clamps, the manufacturer states, retain all the features of past O-B strain

clamps and in addition offer the advantages of lighter weight (50 per cent less), lower cost and increased holding power (90 per cent or more of the rated strength of the A.C.S.R. or copper conductors within the size range of the clamp). The six clamps in the new line are evenly graduated as to seat sizes. Keeper-pieces are non-reversible.

BALANCE

Low price and great accuracy are the principal features noted for the "Bennett Balance" offered by the Chemical Publishing Co. of N. Y., Inc., New York City, for laboratory and field use.



The balance weighs up to 100 grams with a sensitivity of 1/100 gram. Weight is less than 1 lb., it is pointed out, and length is approximately 12 in. There are no loose weights to be lost, and, because of its size and weight, the balance can be carried from place to place in the pocket, the makers state. Price is $5.